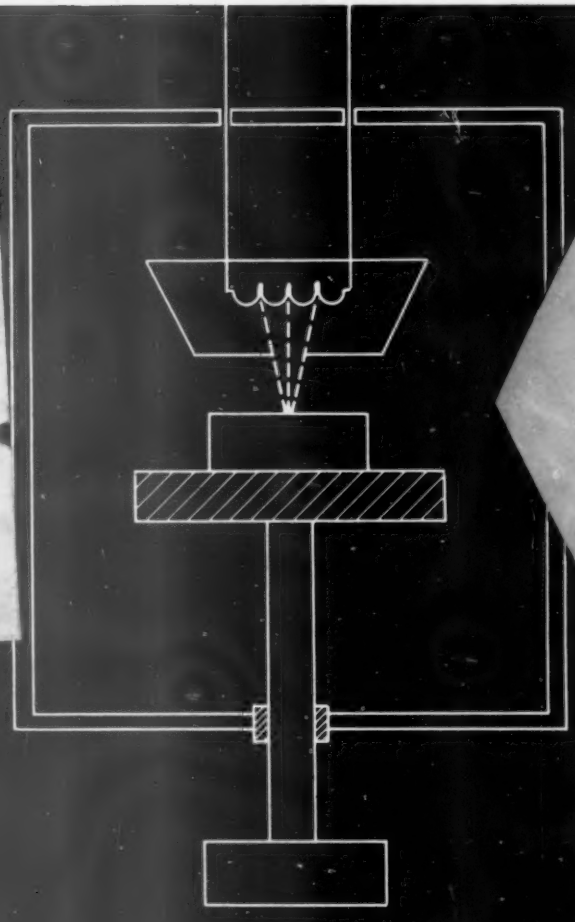
Welding Design & Fabrication

ESTABLISHED IN 1930 AS INDUSTRY & WELDING

MAY 1960



STEVENS RICE
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Electron Beam Welding: Strong, Ductile Welds In The Active Metals

BERYLLIUM
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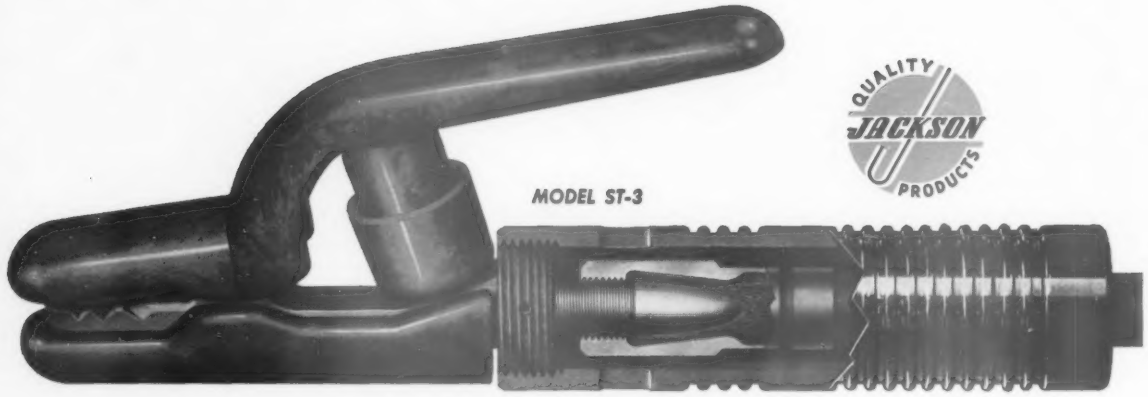
AN INDUSTRIAL PUBLISHING CORPORATION MAGAZINE

ALSO IN THIS ISSUE

WELDING DISTRIBUTORS HOLD CONVENTION IN CHICAGO

HOW GENERAL MOTORS DESIGNS A WELDED TRUCK FRAME

WELDING MANUFACTURERS EXHIBIT AT DESIGN ENGINEERING SHOW



new . . .
Sealed Tight

JACKSON SERIES ST electrode holders offer a *Sealed Tight* mechanical cable connection that gives you practically one-piece conductivity between cable and holder. Tongs are of heat-treated 98% copper alloy.

The stripped cable strands are completely *Sealed Tight* within a *connection nut*, making all-around *tight* metal-to-metal contact with the holder tong, *sealed* against moisture and dirt. The cable jacket is also *Sealed Tight*. The connection nut, by providing an all-around *tight* support of the cable jacket, allows no strain on the cable strands which usually occurs through flexure and tension.

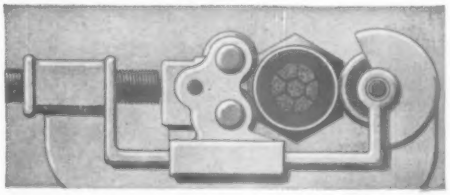
This cable connection is quick and lasting, requiring no maintenance during the normal life of copper or aluminum cable.

Large, ventilated handle threads onto a non-conductive asbestos bushing, has no direct metal contact with tong or cable connection, resulting in an extremely cool working holder.

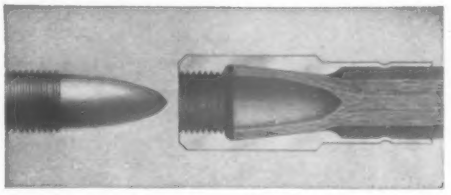
Should the "stinger end" of the holder require service of any kind, it may be quickly replaced without disturbing the actual cable connection. This important feature greatly reduces holder down-time and effects savings in cable cost.

Copper alloy lower jaw terminates in a point, silver-plated for greatest conductivity. When nut is tightened, cable strands are equally disposed around this point, *Sealed Tight*.

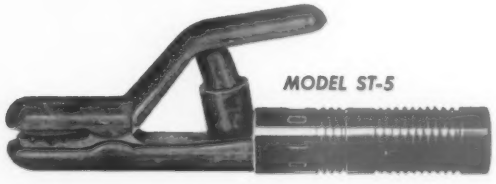
The nut extends backward, forming a ferrule around the cable jacket. This *Sealed Tight Connection Nut* is made in sizes to fit cables No. 1, 1/0, 2/0, and 3/0.



For a *truly permanent nut-to-cable connection*, the ferrule of the nut is crimped around the cable jacket, using Jackson's inexpensive, fast-acting crimping tool.



Detachable Stinger feature enables the operator to detach the "stinger end" by unscrewing it from the connection nut. The cable strands stay in place inside the nut.



Sold Everywhere by Better Welding Supply Dealers

MADE IN TWO SIZES . . .

Model ST-3, "Sealed Tight" Insulated Copper Alloy Holder Electrodes through ¼" • 300 Amps • 10" long

Model ST-5, "Sealed Tight" Insulated Copper Alloy Holder Electrodes through ⅜" • 500 Amps • 11½" long

Jackson Products

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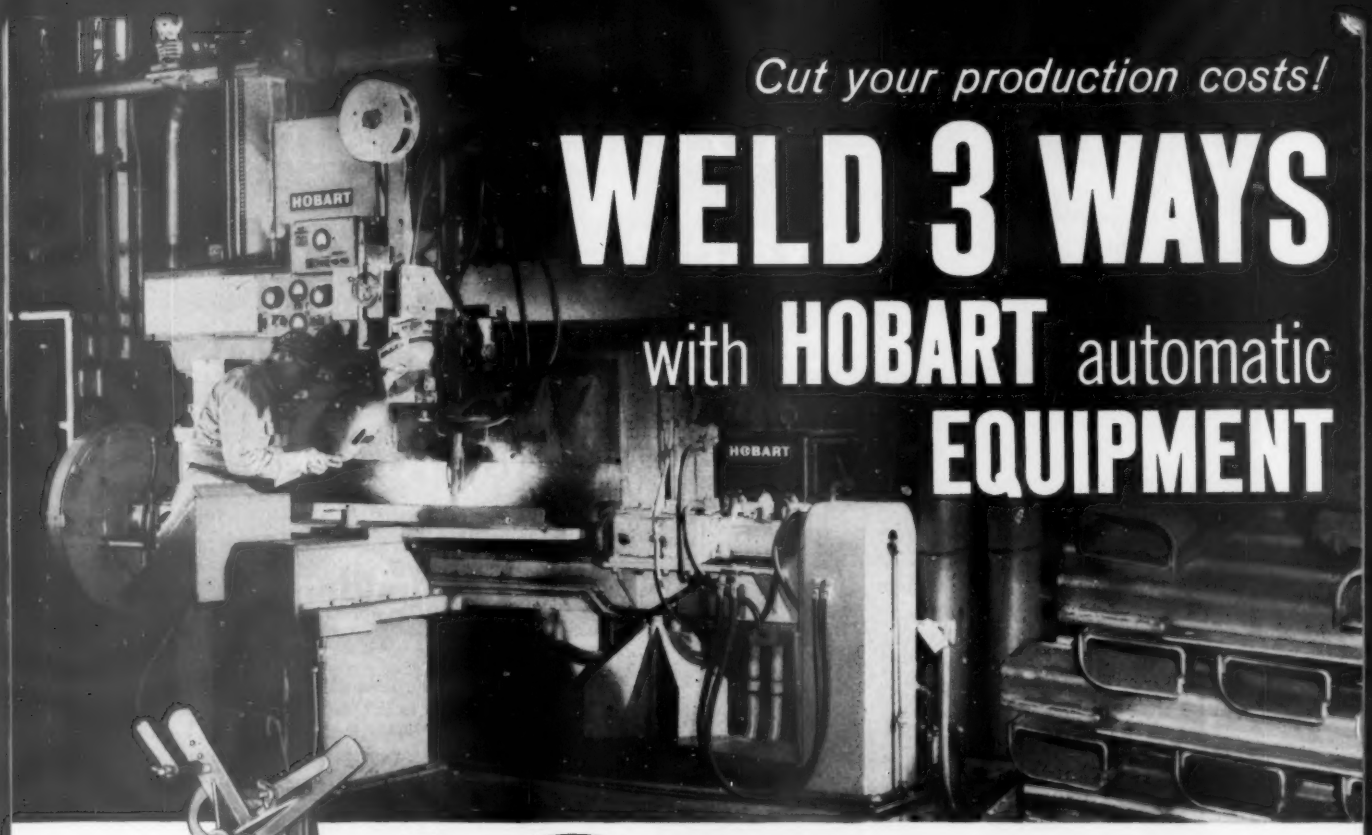

SO VERSATILE you can use it for—

1. **INERT GAS** The basic unit welds aluminum, stainless, monel, inconel, steel and other metals.
2. **CARBON DIOXIDE (CO_2)** Just change to waterless side delivery nozzle (at left) for welding steel and some alloys.
3. **SUBMERGED ARC** Add this flux hopper for welding steel and alloys.

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No. 2 CO_2 Nozzle and No. 3 Flux Hopper are optional components at slight extra cost.

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EXCLUSIVES! — found only in new Miller BWC-300MAP:

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2. **Arc stability WITHOUT HIGH FREQUENCY at as low as 18 amperes.**

The outstanding versatility of this welder, and the specifics on its various features, are detailed fully on our form #BW-3 — a copy of which will be sent to you promptly upon request.

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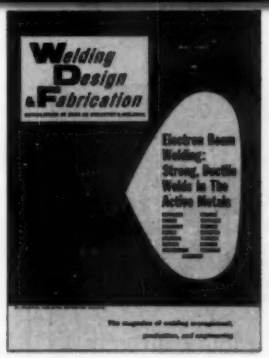

for May, 1960

COVER: Electron beam welding is fast becoming important for making strong, ductile welds in the active metals, as well as in aluminum, stainless, and carbon steels. Welding is done in a vacuum. This eliminates the oxidation problem encountered when the active metals are welded outside a vacuum or without gas shielding. High temperatures generated and the physical and electrical impact of high-energy electrons melt out impurities which are attracted by and adhere to the electron welding gun. See page 32 for full details.

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FEATURES

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High temperatures and the impact of high-energy electrons melts out impurities, makes strong, ductile welds in the active metals.

36 **HOW TO GET BETTER WELDMENTS . . . FASTER**
There's more to weldments than welding. The author discusses welding speeds and gives tips on design, fabrication and welding.

38 **LIGHTER, STRONGER FRAME IS FABRICATED FROM HIGH-STRENGTH STEEL**
New highway tractor frame weighs half as much as a conventional channel type; welded I-beams are the basic building units.

45 **CONTINUOUS FLUOROSCOPY SPEEDS INSPECTION OF WELDED PIPE**
U.S. Steel uses fast, efficient fluorscopy to check the entire length of each weld in large diameter pipe for oil and gas transmission lines.

46 **HIGHWAY BRIDGE FLOOR PANELS ARE DESIGNED FOR WELDING**
Careful integration of fabricating and welding procedures was needed to do a good job on 700, 7½ by 26-foot bridge floor panels.

50 **HOW ROCKETDYNE SAVES ROCKET PUMP TURBINE WHEELS**
Two bright employees won over $4,000 because they found a way to repair one of the costliest parts of a rocket engine fuel pump—the turbine wheel.

52 **TRAVELING AUTOMATIC WELDER STEPS UP TANK PRODUCTION**
A new track-mounted automatic welder is the most important part of a 5-point expansion program aimed at increasing beverage tank production.

54 **WHY VACUUM BRAZING MAKES BETTER JOINTS**
Many metals are easy prey for harmful gases sometimes found in the cleanest furnace atmospheres; there are no contaminants in vacuum brazing.

56 **CURRENT ANALYZER REDUCES SPOT WELDING SET UP TIME**
Instrument measures current and time to insure the application of resistance welding schedules that will produce the best welds.

60 **HOW TO WELD MOLYBDENUM**
The first in a series of three articles on fusion welding molybdenum. Arc and resistance welding will be discussed in succeeding issues.

64 **SQUARE CUTS SPEED WELDING OF PIPE AND TUBING**
Blade steering control on band saw machine keeps cuts square, increases blade life as much as 50 percent.

66 **MILES OF WELDED STEEL PIPING MAKE SKATING RINK ICE**
An engineering firm was able to check a welded steel piping system after one season's use. Welds were sound and there was no corrosion.

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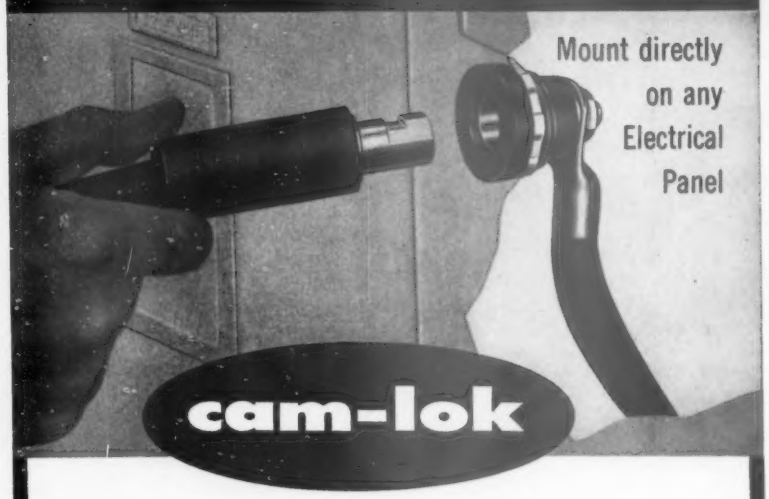
New Hi-Impact Plastic Insulated Panel Receptacles and Mating Plugs



Now, you can make fast, positive power connections to any metal panel or housing without special insulating materials. Simply punch out a hole and insert a Cam-Lok self-insulated Receptacle! Uses standard electrical lock-nuts, affords "dead-front" protection. Push in and twist Cam-Lok mating Plug and you've made a locked connection, which can be released quickly.

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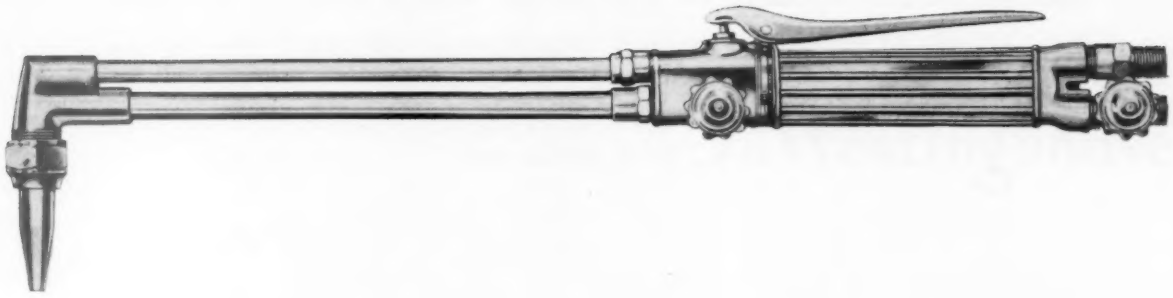
WHAT FEATURES DO *you* NEED IN A CUTTING TORCH?



In the Victor line you'll find all the features you want! You have a choice of preheat gases, heads, lever positions, lengths, wide operating range.

FOR ACETYLENE: Model ST and MO series hand-cutting torches.

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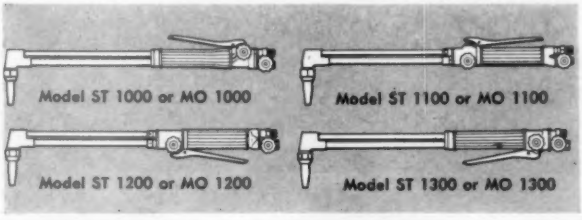
HEADS: You can have either Everdur bronze (ST) or Monel (MO) head, angled at 90°, 75°, 180° . . . or 45° (ST models only).

OXYGEN LEVER POSITIONS: Four, as shown.



LENGTHS: 21", 27", 3' and 4'. (Special lengths on request).

OPERATING RANGES: Standard ST and MO models cut to approximately 8", using acetylene tips to size 5. Heavy duty (HD) models are available for work requiring tips above size 5, for gouging, scarfing, scrap cutting, etc. The new STN series use natural or propane type tips to size 8.

Remember, you can get Victor cutting attachments and machine cutting torches for use with acetylene—also for use with low or medium pressure natural or propane type gases. For the finest choice in cutting equipment, call on your Victor dealer now.

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66

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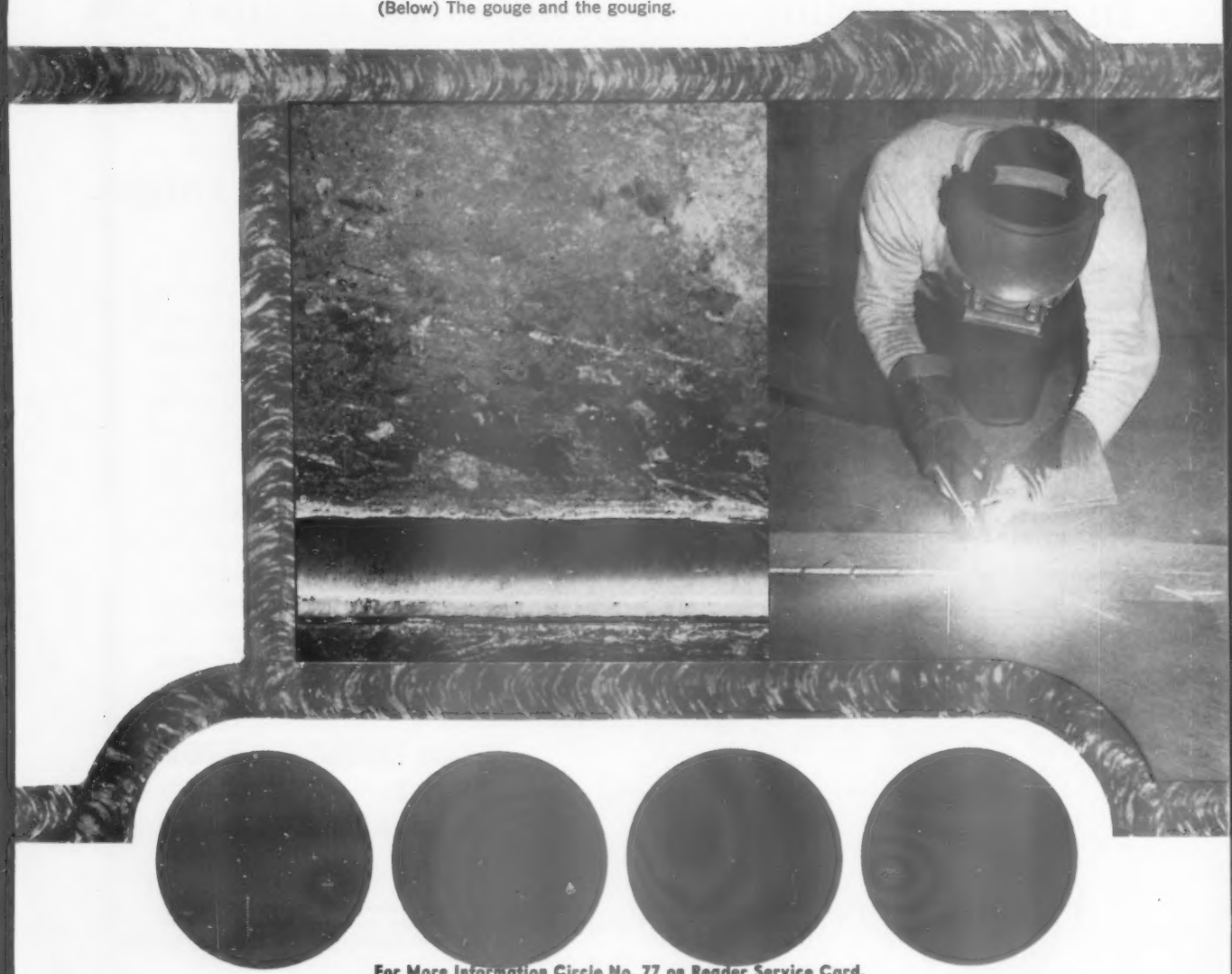
Weld or gouge—be SURE you do it with the 500-amp WS because, in addition to the natural advantages of a hermetically sealed, high capacity, silicon diode rectifier, it affords threefold protection.

Three automatic protection features eliminate the need for special precautions by the operator. First: an exclusive surge suppressor circuit to protect against transient voltage spikes. Second: an integral transformer thermal switch that prevents overheating with prolonged use. Third: an exclusive time and current sensing

(Below) The gouge and the gouging.



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designed specifically for arc-air gouging, too!

relay circuit that prevents damage from the above normal current or above normal duty cycle.

You benefit with greater production and fewer repair bills. What's more, you have a dual-purpose unit that can both weld and arc-air gouge, a welder you can count on to work whenever you need it.

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watch Westinghouse for new developments in welding!

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The new WS welder.

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WELDING AT WORK

to do the job better and cheaper

Giant ore hauler is made from welded T-1 steel

TULSA, OKLAHOMA: This diesel-electric powered ore hauler will carry up to 55-tons. Produced by Unit Rig and Equipment Co., it can dump its entire load in 23 seconds.

The dump body was made of ½-inch T-1 plate (bottom, sides, and front) and ⅝ inch T-1 wear plate (wear area bottom, side and front slopes). Welding was done with the National Cylinder Gas Dual Shield semi-automatic welding process using #150 Dual Shield electrodes.

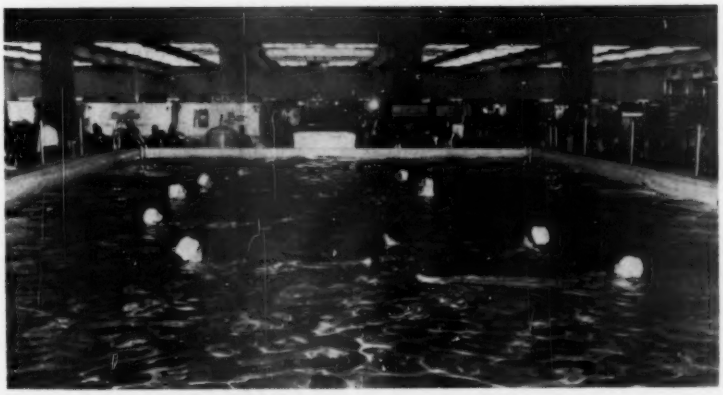
Dye penetrants detect defects in pressure vessels

LOS ANGELES: This is one of three large pressure tanks fabricated by Research Welding & Engineering Co., Inc. for the Rocketdyne Model RS-2 sled. The sled is powered by a liquid propellant rocket engine and uses high pressure nitrogen gas to force liquid oxygen and alcohol into the combustion chamber.

The liquid oxygen tank is made of .375-inch 6061-T6 aluminum because it has good physical properties at extremely low temperature. The alcohol tank also operates at 650 psi; it is made of .100-inch AM 350 steel, a semi-austenitic steel which can be heat treated to high strength levels while retaining good ductility. The nitrogen tank operates at 3000 psi; it is made of .350-inch AM 355 steel.

The Met-L-Chek visible penetrant inspection process was used to test welds because it can be done quickly and accurately after each pass. This interpass inspection detects surface discontinuities which can then be corrected, assuring defect-free welds that pass final inspection by X-ray or hydrostatic inspection (shown).

Complete your shop



All-aluminum swimming pool installed in just 35 hours

NEW YORK CITY, N. Y.: A 55,000-gallon, all-aluminum alloy swimming pool, the largest ever installed in the Coliseum, was built in just 35 hours in time for the opening of a national swimming pool exposition.

The builders, Chester Products, Inc., Hamilton, Ohio, used a three-man team and Linde Sigma welding to complete the 30- by 60-foot pool. Seams were welded at 20 ipm with an HW-11 torch, Alcoa 5154, 1/6-inch wire, and argon gas shielding.

Pool floor sections were first tacked; then they were finish welded. Next, 30- by 4½-foot wall sections, made of 5050-H34 aluminum alloy and containing pool piping, were positioned and tack welded to the floor. Next, aluminum channel braces were fastened to the pool outside to make it self-supporting. Finally, all seams were completed and vacuum-seam tested.

High-strength steel helps boats take corrosion, impact

LOREAUVILLE, LA.: Roustabout boats, built by Breaux's Bay Craft Boats, Inc., to carry oil drilling crews and supplies to many offshore rigs in the Gulf of Mexico and foreign waters are made of strong, corrosion-resistant low-alloy high-tensile steel.

The roustabout shown is being built to operate in the brackish water of Venezuela's Lake Maracaibo by the Mene-Grande Oil Company, a Gulf Oil Subsidiary. Hull plating, decks, and sometimes cabins are fabricated from readily welded Jalten, a product of Jones and Laughlin Steel Corporation. Hulls are made of 10-gage steel, decks and cabins of 13-gage material.

continued on next page

Complete your shop with this modern metallizing installation

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Sprays any metal that can be drawn into wire form.

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- **Apply long-wearing, corrosion-resistant coatings**

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Electrodes make grab bucket points last twice as long

ONTARIO, CANADA: Grab buckets used by Ontario Marine & Dredging Co., Ltd., to extract crushed rock from a canal bed, lasted only two or three weeks when the managanese steel points were welded to the 1020 bucket body with expensive 18-8 stainless steel. The points broke because of severe impact.

By switching to a nickel-manganese-iron alloy electrode, Wall Colmonoy Walmang No. 3, point life was doubled. The electrode is applied by arc welding using d.c. reverse polarity.

Another life-shortener to bucket points is abrasion. Ontario increases the wear-life of points (austenitic manganese steel) by hard-surfacing them with Colmonoy No. 1. This is also applied by arc welding.

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You're all set for the tough jobs

...WITH THIS #545 DOCKSON OUTFIT

#545 OUTFIT, right, is fast and versatile. Cuts up to 5" thick steel. Welding torch is ideal for light plate or heavy castings. Rigid one-piece silver soldered construction and long-life, special rubber, mixer sealing rings.

#600 OUTFIT, below, can weld up to 3/16" thickness and cut up to 1/2" thickness. A compact, lightweight Outfit suitable for all ordinary welding jobs in smaller shops.

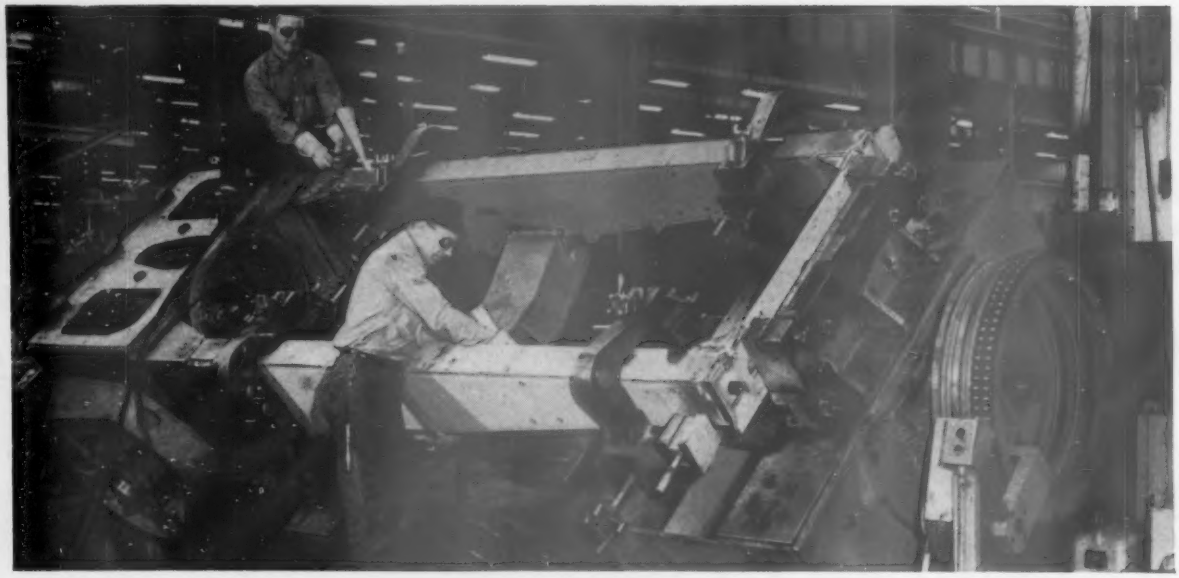
Dockson Outfits are standard catalog items and replacement parts are available quickly when needed.

IF IT'S DOCKSON IT'S

Built for Better Service

Dockson CORPORATION

3839 WABASH AVENUE
DETROIT 8, MICHIGAN



There's more to Welding Wire than the analysis

Particular welding jobs call for particular welding wires—and you might think that one wire is as good as another so long as it has the right chemical analysis. But there's more to it than that.

Take Caterpillar Tractor Co., for example, which is a large consumer of welding material. Just identifying and using the correct analysis isn't enough. Caterpillar also requires efficient packaging and coiling—uniform temper and finish—consistent metallurgical characteristics. In fact, it is at Caterpillar's suggestion that PAGE now color-codes coils for quick identification. Caterpillar uses PAGE welding wire because it meets the requirements—regularly. In your own welding operations, you can count on the same high standards when you specify PAGE.

This tractor is typical of the hard-working, dependable products made by Caterpillar. PAGE **Analysis 8620** is used to obtain high strength welds with maximum ductility on alloy steel.

Let PAGE Help Solve Your Welding Problems

These Folders can help you

Write for:

Folder DH-402-C
Contains information on submerged arc and inert gas automatic welding wire. Lists descriptions and uses of the many PAGE analyses. Describes our extensive variety of packaging. Illustrated.

Folder DH-1218 • Chart lists detailed analyses of PAGE automatic welding wires, metal spray wires, bare electrodes and gas welding rods. Shows uses and physical properties. Lists most competitive makes.

When you bring your welding problems to PAGE, you get the benefit of over half a century of wire drawing experience and leadership in metallurgical research. Leadership evidenced by the industry's widest range of analyses —33 grades designed to do an endless variety of welding jobs. Let PAGE help you improve your quality and lower your costs by furnishing the right wire for your job.

PAGE wire packaging is designed to give you the utmost in convenient storage and handling, whether you require a 1# spool or a 1200# payoff-pallet. Prompt delivery is assured from a coast-to-coast network of PAGE distributors backed up by strategically located PAGE warehouses.

You will find it is "good business" to bring your problems to PAGE.

ACCO

PAGE WELDING WIRE

Page Steel and Wire Division • American Chain & Cable Company, Inc.

Monessen, Pa.*, Atlanta, Chicago*, Denver*, Detroit, Houston*, Los Angeles*, New York, Philadelphia*, Portland, Ore., San Francisco*, Bridgeport, Conn.

**Indicates PAGE warehouse stocks*

PAGE—THE SOURCE FOR ANSWERS TO WELDING PROBLEMS

For More Information Circle No. 53 on Reader Service Card.

Worn cast iron paper stock pump

...repaired with Ni-Rod "55" electrode

...goes right back on the job

New "lease on life" for iron castings with Ni-Rod "55" electrode

When workers at Austell Box Board Corp. in Georgia pulled this cast iron slurry pump for inspection, they found the inner shell (above left) chewed up by abrasion, with finger-size cracks and gouges.

Scrap it? Not on your life. Down at Austell, they *repair* iron castings. Do it easily with Ni-Rod "55"* electrode.

First, surfaces are thoroughly cleaned. Then cracks and worn areas are filled with Ni-Rod "55". Use of metal arc process enables the welder to operate in close quarters without difficulty.

No pre-heat or post heat is needed. Slag chips off easily after each pass. In a short time the pump's back on the job.

Helpful booklet answers many welding questions

"A Handy Guide to Welding Cast Irons" illustrates the many different repair jobs you can do with Ni-Rod "55". It also covers technical data and gives helpful welding tips. For your copy, just write us.

*Inco trademark

HUNTINGTON ALLOY PRODUCTS DIVISION
The International Nickel Company, Inc.
67 Wall Street New York 5, N. Y.

INCO WELDING PRODUCTS
TRADE MARK
electrodes • wires • fluxes

For More Information Circle No. 34 on Reader Service Card.

NEW!

Linde SIGMATIC Welders

SWM-13 cart-mounted unit with separate control cabinet rolls readily over hoses, minor obstacles, slings easily from adjustable handles.

SWM-12 sled-mounted unit with separate control cabinet passes easily through small openings, can be slung from rigid tubular handles.

For More Information Circle No. 39 on Reader Service Card.

for All Mig Welding Jobs

LINDE's new "Sigmatic" line gives you the most adaptable and versatile mig welding equipment available today. With one of these units, you can weld virtually any metal, in almost any thickness. You can use wire from .020 in. to 3/32 in. diameter (including cored wire) and any shielding gas you select.

Versatility is engineered into the "Sigmatic" line. On the SWM-11, you can change from horizontal to vertical wire feed in minutes. With any unit, you can use conventional "spray-arc" or the LINDE "short-arc" process which has proved so successful on thin steels. Dual-purpose units are available which handle both spot welding and continuous fusion welding.

Several styles of torches are available, ranging up to 500-ampere capacity. Control cabinets are designed and wired for maximum ease of service and for internal addition of special operating features selected to fit *your* needs.

The same development and laboratory facilities that planned and built this equipment are available for help in applying it to your welding problems. For information on a demonstration see your LINDE representative. Or write for catalog F-1372, Dept. WDF-05, Linde Company, 270 Park Avenue, New York 17, N. Y.

SWM-11 features compact mounting of wire feed unit and wire spool on angular welded steel structure; combination continuous-fusion and spot-welding unit, SWM-11-S, is also offered.

LINDE COMPANY UNION CARBIDE

"Linde", "Sigmatic", and "Union Carbide" are trade marks of Union Carbide Corporation.

For More Information Circle No. 39 on Reader Service Card.

DO YOU HAVE A WELDING PROBLEM?

Call Your

Local Welding Distributor

- HE KNOWS THE BEST SOLUTION
- HE GIVES YOU QUICK SERVICE
- HE MAINTAINS A GOOD INVENTORY

he'll explain how

TPC* MAKES **HI-AMP®** ACCESSORIES COOLER

***THREADED POWER CONNECTION**

- GIVES EXCELLENT ELECTRICAL CONNECTIONS
- ADAPTABLE TO GROUND CLAMPS, QUICK DISCONNECT PLUGS, ELECTRODE HOLDERS.

Write for **FREE** booklet "Reducing Costs By Proper Care Of Arc-Welding Circuits"

LENCO, INC.

P. O. Box 189A Jackson, Mo.

For More Information Circle No. 37 on Reader Service Card.

LIBRARY

of welding

Gas Shielded-Arc Welding

"Gas Shielded-Arc Welding" by the American Welding Society, 33 West 39th St., New York 18, New York; 78 pages; $1.50

The first American Welding Society book on the gas shielded-arc welding processes has just been published. Containing 78 pages, 39 illustrations and 9 tables, the book describes in detail the group of processes which originally went under the name of inert-gas processes. The development of shielding gases, such as CO_2, which are not inert, caused the change of name.

The contents are taken from published and unpublished material from Sections I, II, and III of the Fourth Edition of the *Welding Handbook*. Included in this small, authoritative book are: gas shielded tungsten-arc welding; gas shielded metal-arc welding (including CO_2 welding); cutting; gases; equipment; and cost data.

The book is profusely illustrated. Photographs, schematic diagrams and charts show every step of the way.

Gas Shielded-Arc Welding is currently being used as a text for an intensive course presented on the subject by the American Welding Society.

Fusion Welding Aluminum

"Fusion Welding Aluminum" by Reynolds Metals Co.; 32 pages; free.

This is the latest addition to Reynolds Metals Company's comprehensive series of technical handbooks on methods for joining aluminum.

The paper-bound, 6- by 9-inch booklet covers these welding processes and their use on aluminum: metal arc, tungsten-inert gas, consumable electrode-inert gas.

Design of welded joints is covered in detail.

The new technical handbook is available on letterhead request from Reynolds at Dept. PRD-31, Richmond, 18, Virginia.

Circle No. 27 on Reader Service Card. ⟶

Facts At Your Fingertips

If you want details about products described or advertised in this issue, circle the number on the card that corresponds with the number under each advertisement or product description.

WELDING DESIGN & FABRICATION

MAY 1960,

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These cards are your tickets to this prompt service. Use them to secure details about any item in this issue that has a key number. For instance:

ADVERTISEMENTS — a showcase of the latest in components, equipment & techniques.

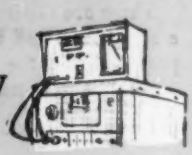
NEW PRODUCTS — brief descriptions of significant new products and materials.

NEW LITERATURE — offerings of new catalogs, data books, price lists, and other valuable reference material.

NOW! YOU CAN
AUTOMATE

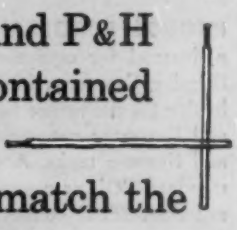
If profitable arc-welding is important to you, then you ought to investigate the complete line of modern Harnischfeger

equipment. For example, P&H weld-programming with motorized rheostat or sequence-timers enables you to weld Space Age and other super-critical metal automatically! Or you can automate your welding

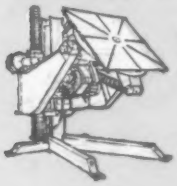


with P&H punched-tape control. Both are infinitely versatile and standardize weld quality at levels

impossible with manual controls. P&H also offers you industry's most complete line of industrial welders — 1 to 750 amps. — AC, DC, or dual AC/DC machines with h-f, spot gun, and gas and water controls. And P&H engine-driven welders give you compact, self-contained 25- to 500-amp. weld-power for field jobs. The



different types of P&H electrodes enable you to match the



analysis and properties of many weldable parent metals. And you can cut welding labor and overhead costs in half with P&H welding positioners. So...

WELD MODERN WITH P&H EQUIPMENT

Literature available on all products.

Export Division:
4329 W. National Ave., Milwaukee, Wis.
P&H welding equipment is manufactured and sold in Canada by REGENT EQUIPMENT MANUFACTURING CO., LTD., 455 King St. West • Toronto, Ontario, Canada.

P&H HARNISCHFEGER
WELDERS • ELECTRODES • POSITIONERS
MILWAUKEE 46, WISCONSIN

239

WELDING MANAGEMENT

watches these developments

A DOUBLING OF THE AMERICAN ECONOMY; a nation one-third larger in customers, 50 percent richer per customer; demands for electricity about triple today's requirements; total purchasing power of families over $10,000 equaling today's *entire* consumer marker.

These are the broad dimensions of the U. S. economy by 1975, according to a significant and unusual study, "The Years Ahead: 1960 to 1975," recently prepared for the American-Marietta Company. Copies are available from American-Marietta's Department of Information at 101 E. Ontario St., Chicago.

"ADVANCES IN RESISTANCE WELDING" is the theme of our annual resistance welding issue which we will publish in June. Featured will be a complete section with application-type articles that show how industry is using the latest equipment to increase resistance welding speed and quality. You'll also find a section of new products for resistance welding in that issue.

ENOUGH EUROPEAN CYLINDERS are being used in this country to create a demand for equipment to charge them. To satisfy this demand, Bastian-Blessing Company, Chicago, is furnishing oxygen and acetylene adapters that bridge the difference between this country's standard pigtail outlet connections and European connection forms. Adapters are available for British, Swedish and German tanks. Acetylene cylinder connections may be adapted to either standard POL or commercial connections. Oxygen adapters are for the standard CGA #541 connection form (.903"-14NGO-RH).

STEELMAKING FURNACES poured 11,119,000 net tons of ingots and steel for castings during February, a record for that month, according to the American Iron and Steel Institute. The total compared with January's 12,049,404 tons, the all-time monthly record, and with 9,602,938 tons poured in February 1959.

OVER HALF (52 percent) of all cobalt 60 isotopes shipped by the U. S. Atomic Energy Commission in 1959 were bought by the Instruments Division of The Budd Company, Philadelphia. The AEC sold 169,000 curies of cobalt in 1959, of which Budd's Instruments Division bought over 89,000 curies. Among the uses for the cobalt: Power sources in Mulitron radiography machines for detecting flaws in weldments or castings.

SALES WERE UP 17 percent in 1959 for 218 distributors members of the National Welding Supply Association. These facts were reported by the distributors to Association headquarters. They also reported a 12 percent increase in sales for the fourth quarter, 1959, compared to the same period in 1958.

MORE AND MORE WELDING MANUFACTURERS are becoming aware of the increased interest in one of the most important phases of the total welding function: the design of a welded product. As a result, 20 manufacturers will have displays that feature and explain welded design at the Design Engineering Show which will be held at New York City's new Coliseum on May 23 through 26. Twenty thousand engineers and company executives, whose responsibility it is to design the product of tomorrow, will attend the show. WELDING DESIGN & FABRICATION, which also recognizes the importance of the design function to the continued growth of the welding industry, will have a booth at the show. See page 26 for complete details.

FREE DEMONSTRATION

Talk to your nearest RANSOME distributor about an automation package. Any of the RANSOME distributors listed below can arrange a free demonstration for you.

ALABAMA
Ebbert & Kirkman Co., Inc.—BIRMINGHAM
CALIFORNIA
Anderson Equipment Co.—LOS ANGELES
W. H. Douthitt Steel & Supply—EL CENTRO
Heidt Equiment Co.—OAKLAND
Moore's Welding Supply—SACRAMENTO
G. S. Parsons Co.—SAN DIEGO
A. G. Pond Co.—SAN JOSE
CONNECTICUT
Zane Weldcraft Supplies, Inc.—HARTFORD
FLORIDA
Duval Welding Supply Co.—JACKSONVILLE
General Welding Supply Co.—TAMPA
Kennerk Welding Supply Co.—MIAMI
GEORGIA
Keenan Welding Supply—ALBANY
Pye-Barker Welding Supply Co.—ATLANTA
Savannah Oxygen & Supply Co.—SAVANNAH
ILLINOIS
A. E. Dailey Co.—MOLINE
Machinery & Welder Corp.—CHICAGO
INDIANA
Allied Weldcraft, Inc.—INDIANAPOLIS
C. A. Schrader Co.—MISHAWAKA
KENTUCKY: Ki-Weld Supply Co.—LOUISVILLE
LOUISIANA
Woodward Wight & Co.—NEW ORLEANS
MAINE
Maine Oxy-Acetylene Supply Co.—AUBURN
MASSACHUSETTS
G. L. Merriam Co.—GREENFIELD
Welders Supply Co.—BURLINGTON
Welders Supply Co.—CAMBRIDGE
Welders Supply Co.—WORCESTER
MICHIGAN
Lake Welding Supply Co.—MUSKEGON
Robinson Welding Supply Co.—DETROIT
Tupes of Saginaw, Inc.—SAGINAW
MINNESOTA
W. P. & R. S. Mars Co.—DULUTH
MISSOURI
McDonald & Wilson Sales Co.—ST. LOUIS
NEW HAMPSHIRE
N H. Welding Supply Co.—MANCHESTER
NEW JERSEY
Essex Welding Equipment Co.—NEWARK
Mid-Jersey Equipment Co.—LIVINGSTON
NEW YORK
General Welding Supply Corp.—WESTBURY
Cottet Welding Supply Co., Inc.—SYRACUSE
Mills Welding Supply Co.—BUFFALO
OHIO
James C. Dawes Co.—MARTINS FERRY
Okiva, Inc.—CINCINNATI
Scott-Tarbell, Inc.—CLEVELAND
Welders Service Co.—TOLEDO
OKLAHOMA: Oklahoma Oxygen Co.—TULSA
OREGON: J. E. Haseltine & Co.—PORTLAND
PENNSYLVANIA
Boyd Welding Co.—ERIE
J. A. Cunningham Equipt.—PHILADELPHIA
The Ransome Co.—PITTSBURGH
RHODE ISLAND
Industrial Welder's Supply Co.—PROVIDENCE
SOUTH CAROLINA
Industrial Welding Supply—CHARLESTON
TENNESSEE
Oxygen Service Co.—KINGSPORT
Brooks Welding Supply—CHATTANOOGA
TEXAS
Big Three Welding Supply—FORT WORTH
Big Three Welding Equipment—HOUSTON
UTAH: Whitmore Oxygen Co.—SALT LAKE CITY
WASHINGTON J. E. Haseltine & Co.—SEATTLE
WEST VIRGINIA
Virginia Welding Supply Co.—CHARLESTON
WISCONSIN
Machinery & Welder Corp.—MILWAUKEE
CANADA—MONTREAL, TORONTO, WINDSOR
Rudel Machinery Co., Ltd.
FRANCE
Petro Fouga-PARIS-Licensee for French Communite

Circle No. 59 on Reader Service Card. ⟶

AMPCO-WELD®

WIN ON THE MOVE

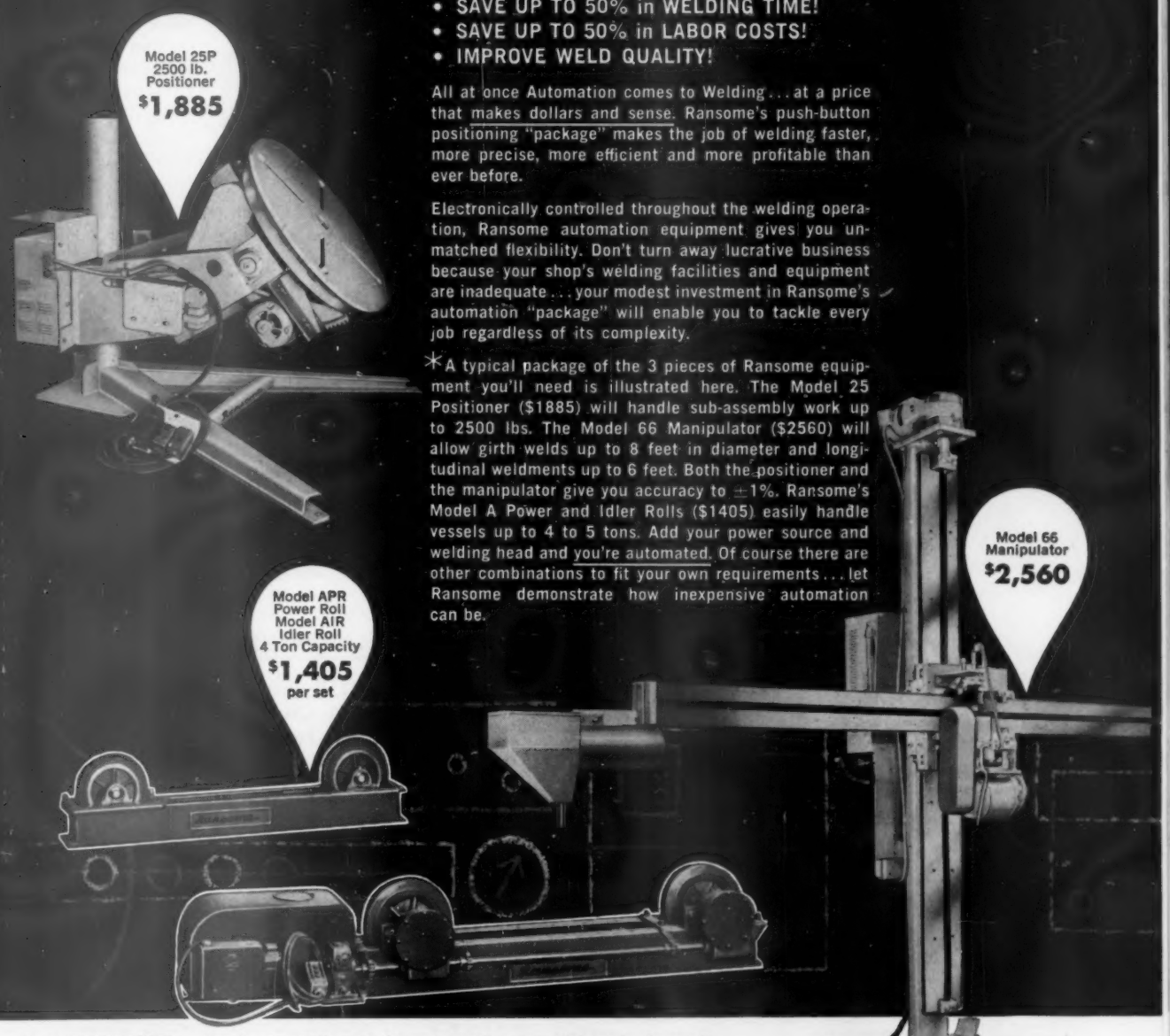
NOW! YOU CAN AUTOMATE YOUR WELDING FOR $5,850.*

- SAVE UP TO 50% in WELDING TIME!
- SAVE UP TO 50% in LABOR COSTS!
- IMPROVE WELD QUALITY!

All at once Automation comes to Welding... at a price that makes dollars and sense. Ransome's push-button positioning "package" makes the job of welding faster, more precise, more efficient and more profitable than ever before.

Electronically controlled throughout the welding operation, Ransome automation equipment gives you unmatched flexibility. Don't turn away lucrative business because your shop's welding facilities and equipment are inadequate... your modest investment in Ransome's automation "package" will enable you to tackle every job regardless of its complexity.

*A typical package of the 3 pieces of Ransome equipment you'll need is illustrated here. The Model 25 Positioner ($1885) will handle sub-assembly work up to 2500 lbs. The Model 66 Manipulator ($2560) will allow girth welds up to 8 feet in diameter and longitudinal weldments up to 6 feet. Both the positioner and the manipulator give you accuracy to ±1%. Ransome's Model A Power and Idler Rolls ($1405) easily handle vessels up to 4 to 5 tons. Add your power source and welding head and you're automated. Of course there are other combinations to fit your own requirements... let Ransome demonstrate how inexpensive automation can be.



See RANSOME's standard off-the-shelf automation equipment. Any of the RANSOME distributors listed in the adjoining column can arrange a free demonstration for you. For details on this or other RANSOME automation combinations call/write your nearest RANSOME DISTRIBUTOR.

Ransome Company

MACHINE TOOLS FOR WELDING

Division of Big Three Welding Equipment Co.

Scotch Plains, New Jersey

RANSOME THE PIONEER IN POSITIONING FOR WELDING

AMPCO-WELD®

RESISTANCE-WELDING ELECTRODES AND ACCESSORIES

Longer Runs...

yours with Ampco-Weld Seam-Welding Wheels

Made of durable Ampco alloys, for (1) unusual hardness and toughness at elevated temperatures; (2) exceptional resistance to wear; (3) extra durability; (4) uniformly high electrical conductivity. You get longer service life.

An Ampco-Weld distributor near you can supply rough forged blanks *from stock* — and can give early delivery on wheels machined to your specifications.

AMPCO METAL, INC. Dept. 177E, Milwaukee 46, Wis. • West Coast Plant: Burbank, Calif.

RW-19C

The Ampco-Weld resistance-welding specialist near you is:

Acme Welding Supply Inc. Kansas City, Mo.
Albany Calcium Light Co. Albany, N. Y.
Allen Welding Equipment, Inc. Wichita, Kan.
Arizona Welding Equipment Co. Phoenix, Ariz.
Awoco Supply Co. Tucson, Ariz.
Bailey Equipment Co. San Diego, Calif.
Boyd Welding Co. Erie, Pa.
Frank Brandt Beverly, Mass.
Canton Welders Supply Co. Canton, Ohio
Chicago Welding Sales Co. Chicago, Ill.
Clements Welding & Machinery Co., Inc. St. Louis, Mo.
Corp Brothers, Inc. Providence, R. I.
J. A. Cunningham Equipment, Inc. Philadelphia, Pa.
Dobbins Manufacturing Co. Cleveland, Ohio
R. G. Eide Inc. Minneapolis, Minn.
Eljako, Inc. Nashville, Tenn.
General Distributing Co. Great Falls, Mont.
C. D. Genter Chattanooga, Tenn.
Gibson Welding Supplies Spokane, Wash.
Gweco, Inc. New Orleans, La.
Robt. W. Hoffman Company, Inc. Chicago, Ill.
Industrial Specialties Co. Portland, Ore.
Jaeger Welding Supply, Inc. Springfield, Mass.
Lewis Industrial Supply Co. Louisville, Ky.
Linnehan Welding Supply Co. Milwaukee, Wis.
Metz Welding Supply Co. Milwaukee, Wis.
Miller Equipment Co. Cincinnati, Ohio
Newkirk Sales Co. Waterloo, Iowa
New Mexico Steel Company Albuquerque, N. Mex.
Production Engineering Sales Co. Dayton, Ohio
United Tool & Supply Co., Inc. St. Petersburg, Fla.
Upton Bradeen and James Ltd. Toronto, Montreal, Ottawa, Windsor, Winnipeg, Hamilton, Vancouver, Edmonton, Moncton, Canada
Nat. J. Weiss Sales Associates Union City, N. J.
R. S. Weiss Co. Baltimore, Md.
Weldcraft Equipment Company Pittsburgh, Pa.
Welder Service Co. Toledo, Ohio
Welders Supply Inc. Dallas, Texas
Zane Weldcraft Supplies, Inc. Hartford, Conn.
Valley Welding Supply, Inc. Appleton, Wisconsin

For More Information Circle No. 9 on Reader Service Card.

MEN ON THE MOVE

in the welding industry

PROMOTIONS:

CUSACK

G. C. Cusack is the new president of Pure Carbonic Co., a division of Air Reduction Co., Inc. He succeeds **J. J. Lincoln, Jr.**, who has been transferred to the parent company's executive staff.

Dreis & Krump Mfg. Co., Chicago, has made **R. Johnson** vice president and general sales manager.

Jack D. Tolliver is the newly appointed field sales manager for Tube Turns Division of Chemetron Corp., Louisville.

George Elliot is the new manager of distributor sales for Amperex Electronic Corp., Hickville, New York.

United Welders, Inc., Bay City, Mich., has a new general sales manager. He is **Robert E. Groening.**

APPOINTMENTS:

J. B. Nottingham & Co., Inc., New York City, has appointed two area sales representatives. They are **Charles Petty, Jr.,** Mobile, and **Floyd Davis,** Cleveland, Ohio.

Stanley E. Fey has been named general manager of K-G Equipment Co., Inc., a Division of Air Products, Inc., Allentown, Penna.

Clarence Bennett has been named sales section head of the Welder Product Group at Vickers Incorporated, Electric Products Division, St. Louis.

Joseph DeSanto will be responsible for sales-engineering duties connected with Air Reduction Sales Company's electrode business in the Chicago area.

continued on page 22

THESE ARE EXTRAORDINARY FLUXES

The correct selection of flux can offer unexpected help in speeding and simplifying production, minimizing rejects and lowering costs in low temperature silver brazing operations. The advantages to be gained by "selective fluxing" are *sufficiently important to warrant careful, thorough study!*

Silvaloy offers the most advanced flux developments in this specialized field. Here, is *a complete line of fluxes* . . . each providing outstanding performance, enabling you to select the correct flux for every possible low temperature brazing operation. The extra efficiency of Silvaloy "Selective Fluxing" is being proved daily on the brazing production lines of the country's leading manufacturers.

Call the Silvaloy distributor in your area for consultation and detailed information or, send for our booklet "A Complete Guide to Selective Fluxing for Low Temperature Silver Brazing."

Silvaloy fluxes are packaged in 65-lb. and 30-lb. drums, 5-lb. wide mouth jars (5 to a carton), 1-lb. and ½-lb. jars. The wide opening of the 5-lb. package makes it a most practical, time saving dispenser that also enables the operator to make use of every bit of flux in the jar.

SEND FOR THIS COMPLETE GUIDE TO FLUXING

ENGELHARD
INDUSTRIES, INC.
AMERICAN PLATINUM & SILVER DIVISION
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SILVALOY DISTRIBUTORS: A.B.C. METALS CORPORATION, DENVER, AUSTIN-HASTINGS COMPANY, INC., CAMBRIDGE, WORCESTER, HARTFORD, BURDETT OXYGEN COMPANY, CLEVELAND, CINCINNATI, COLUMBUS, AKRON, DAYTON, YOUNGSTOWN, MANSFIELD, FINDLAY, DELTA OXYGEN COMPANY, INC. MEMPHIS, EAGLE METALS COMPANY, SEATTLE, PORTLAND, SPOKANE, NOTTINGHAM STEEL & ALUMINUM DIV. A. M. CASTLE & COMPANY, CLEVELAND OLIVER H. VAN HORN CO., INC., NEW ORLEANS, FORT WORTH, HOUSTON, PACIFIC METALS COMPANY LTD., SAN FRANCISCO, SALT LAKE CITY LOS ANGELES, SAN DIEGO, PHOENIX, STEEL SALES CORPORATION, CHICAGO, MINNEAPOLIS, INDIANAPOLIS, KANSAS CITY, GRAND RAPIDS DETROIT, ST. LOUIS, MILWAUKEE, LICENSED CANADIAN MANUFACTURER, ENGELHARD INDUSTRIES OF CANADA, LTD., TORONTO, MONTREAL

For More Information Circle No. 8 on Reader Service Card.

Ranite Hardsurfacing Rods

give **BEST RESULTS**

ON

EVERY

JOB

YOU CAN

INCREASE PROFITS WITH ECONOMICAL MAINTENANCE

Ranite Rods:

- GIVE DEPENDABLE WEAR.
- FAST DEPOSITION GETS THE JOB DONE QUICKLY.
- EASY TO RUN—A-C or D-C
- NO SLAG TO FIGHT.
- EXCLUSIVE METALLIC COATING PROVIDES MORE DEPOSITED WELD PER POUND.

Ranite
WELDORS' NO. 1 CHOICE FOR HARDSURFACING

FOR COMPLETE INFORMATION SEND THIS COUPON TO:

RANKIN MANUFACTURING CO. P.O. Box 631, Alhambra, Calif.

Name:.....Title.....

Company:.....

Address:.....

State:.....

CHECK HERE

☐ SEND LITERATURE ONLY AT THIS TIME—DON'T CALL.

☐ PLEASE ADVISE WHERE **RANITE** CAN BE PURCHASED.

☐ WE WOULD LIKE TO DISCUSS OUR HARDSURFACING APPLICATIONS WITH YOUR FACTORY WELDING ENGINEER ON HIS NEXT REGULAR TRIP IN OUR AREA.

For More Information Circle No. 58 on Reader Service Card.

MEN ON THE MOVE

continued from page 20

APPOINTMENTS

McNALLY above

WILCOX above, left

WAITE left

Arcos Corporation, Philadelphia, has named product sales and service managers for three of its product groups. They are **Wayne L. Wilcox** (stainless, low and high alloy welding), **James McNally** (semi-automatic and automatic welding of mild steel) and **Matthew Waite** (welding aluminum, magnesium and reactive metals).

C. M. Burnett has been made district representative of the South-central States for Hobart Bros. Co., Troy, Ohio.

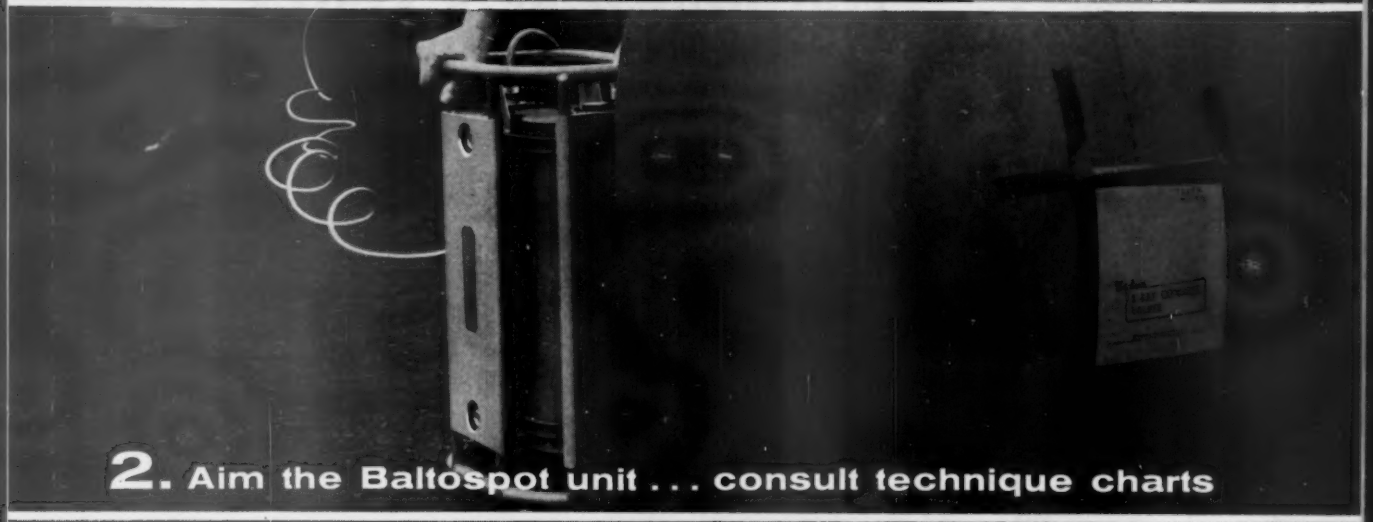
DEATHS:

An airplane accident took the life of **Karl H. Schmuldt,** vice president of K-G Equipment Co., Division of Air Products, Allentown, Penna. Mr. Schmuldt met his untimely death in the crash of a light plane on March 20 near Kingston, New York.

Lockwood Hill, founder and chairman of the Board of Directors, Hill Equipment Co., St. Louis, died of a heart attack on March 24.

Circle No. 78 on Reader Service Card.→

1. Attach the film holder



2. Aim the Baltospot unit . . . consult technique charts

3. Set the controls . . . press the button!

YOU'VE JUST MADE A WELD X-RAY!

Taking repetitive or field X-rays is a 1-2-3 operation with this Baltospot portable unit—can be learned in less than a day. You simply carry the unit to the job, X-ray the weld, and develop the film—all in a matter of minutes.

And don't forget—X-ray weld inspection is a real cost-cutter, too (77% savings on inspection were recently reported by a prominent tank fabricator).

For the whole story, contact your nearby Westinghouse X-ray sales representative. Or write: Westinghouse Electric Corporation, X-ray Department, 2519 Wilkens Avenue, Baltimore, Maryland. J-08378

YOU CAN BE SURE...IF IT'S

Westinghouse

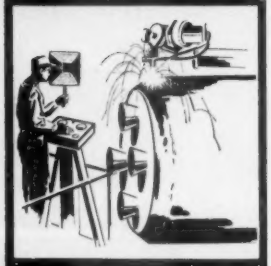
WATCH "WESTINGHOUSE LUCILLE BALL-DESI ARNAZ SHOWS" CBS TV FRIDAYS

CONSTRUCTION: Bridges, buildings, etc. Magnaflux is proved out on important welds.

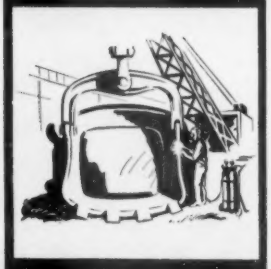
DO YOU INSPECT WELDS FOR UNDER 5¢ A FOOT?....

.... or are you sure of finding all the cracks?

OIL and CHEMICAL: For tubes, pipeline, reactor, or tank—welds proved crack-free, in mill or field.



SPACECRAFT: Critical welds. Often several Magnaflux and other methods needed—on each weld.



HEAVY EQUIPMENT: Manufacture and Repair. Portable and low cost, reliable, reproducable tests.

Unless you use Magnaflux maybe you've *never* tested welds reliably for 5¢ or less a foot. Yet *with* Magnaflux you can do it easily. And you'll be sure of finding *all* the cracks open to the surface—however small or tight. These are the ones it's most important to find!

150 feet per hour @ about 4.4¢ per foot

With Magnaflux testing this is a fair average cost for linear welds. The 4.4¢ per foot of weld includes typical and reasonable man-hour costs for two inspectors, and the small amount of Magnaflux powder used.

For nonlinear welds you should figure about 50% more—say 6.6¢ per foot to cover the cost and time of moving scaffolding, setting up, etc.

For either type of weld, other test methods may cost you 5 to 10 times as much. But low cost isn't the only advantage Magnaflux gives you . . .

Magnaflux finds ALL the cracks

It is the only generally recognized and proven way to find all cracks open to the surface in magnetic metals. These cracks concentrate high stress, and cause most failures in weldments. *Other methods may not find them*—and none will find them so easily and at such low cost. Magnaflux finds most stress-significant sub-surface defects, too. Magnaflux testing does not require highly trained technicians. Equipment may be portable or designed for fixed, production-line testing.

Ask to have a Magnaflux Nondestructive Testing Engineer call—his own experience includes problems, solutions and savings that apply to you! It will pay you to see him *now!*

MAGNAFLUX CORPORATION

A Subsidiary of General Mills

7348 West Lawrence Avenue, Chicago 31, Illinois

New York 36 · Pittsburgh 36 · Cleveland 15
Detroit 11 · Dallas 35 · Los Angeles 22

The Hallmark of Quality in nondestructive test systems

For More Information Circle No. 42 on Reader Service Card.

National Welding Supply Association Meets At Chicago's Palmer House May 5-7

CHICAGO: The National Welding Supply Association will hold its 16th annual convention at the Palmer House on May 5th, 6th and 7th.

OPENS ON THURSDAY

The Convention will begin officially at 2 pm on Thursday, May 5th, with the opening general business session. The opening session will feature the keynote speech: "How to Put More Sell in Your Selling" to be presented by H. B. Sharer, sales training specialist, United States Rubber Company.

A. C. AXTELL

On Thursday evening convention delegates will attend the President's Reception, which will honor retiring President A. C. Axtell, Essex Welding Equipment Co., Newark, New Jersey, and other Association officers.

Friday, May 6th, will begin with a general business session. The principal address on "Motivation of Salesmen" will be given by Ed. J. Hegarty, lecturer and author, Mansfield, Ohio.

CONTACT BOOTH PROGRAM

On Friday afternoon, the Association's annual Contact Booth Program will be held from 1:30 pm to 5 pm. Ninety-four manufacturers will have booths for the program. This figure is an all-time high for the program which is one of the highlights of the convention. This program gives distributors and manufacturer-members a chance to meet and discuss mutual problems.

The Association's annual dinner dance will be held immediately after the conclusion of the Contact Booth Program. Highlights include the introduction of the new president, a floor show and dancing.

CONCLUDES ON SATURDAY

The convention will end on Saturday, May 7th, with a morning business session. New officers will be installed at this meeting. Also on the schedule is a talk on "Why Do Your Customers Buy From You?" by Les A. Thayer, general sales manager, Belden Mfg. Company, Chicago.

The convention will conclude with a talk on "Who Will Succeed in the '60's?" by Dr. Kenneth McFarland, educational consultant, Topeka, Kansas.

LADIES' PROGRAM

While the men are busy with business sessions, ladies will enjoy a coffee hour on Thursday morning, and a tea in honor of Mrs. Axtell on Thursday afternoon. On Friday they will tour the Merchandise Mart and attend a fashion show and luncheon at the Ambassador West.

more news on the next page

R. C. Mahon Builds 1600-Foot Ohio River Bridge

DETROIT: A huge, 1600-foot welded steel bridge, the only one of its kind in the United States, will be built over the Ohio River near Louisville by R. C. Mahon Co. Walter F. Sheetz, Mahon's president, announced his company's Structural Steel Division had been awarded the contract for the bridge, totalling nearly $5.4 million by the Indiana State Highway Commission. The Mahon division competed with four other firms in bidding for the bridge which will cost $15 million.

According to Hazelet & Erdal, Louisville consulting engineers on the job, the structure is of a unique tandem, tied-arch double-deck design that requires fabrication methods used only for the cantilever truss structure that spans the Carquinez Strait in California.

Welding manufacturers exhibit at Design Engineering Show

NEW YORK CITY: American manufacturers will get a glimpse of the products of the future when the Design Engineering Show, largest exposition devoted to research and development, unveils a $10,000,000 exhibit here on May 23. The show will run for four days at the new Coliseum.

Everything that goes into the ultimate product will be shown by exhibiting companies.

More and more welding manufacturers are becoming aware of the increased interest in one of the important phases of the total welding function: the design of a welded product. Some 20 manufacturers will have displays that feature and explain welded design. Welding, cutting and brazing equipment, materials, accessories and auxiliary equipment will be shown.

WELDING DESIGN & FABRICATION, which also recognizes the importance of the design function to the continued growth of the welding industry, will have a booth at the show. This booth will give WD&F editors a chance to meet and discuss welded design with those in attendance. Currently, 6,000 people with responsibility for welded design are receiving copies of WELDING DESIGN & FABRICATION.

Twenty thousand engineers and company executives, whose responsibility it is to design the products of tomorrow, will attend. Virtually, every major manufacturing company in the country will be represented among the visitors. About 15,000 products, which go into the making of end products, will be shown.

Concurrently with the show, and also at the Coliseum, the machine design division of the American Society of Mechanical Engineers will conduct a four-day conference. This year's papers will concern themselves with the application of space-age design theory and techniques to new consumer products.

The opening session on "New Horizons in Engineering Design" will feature design authorities from both the field of space technology and nuclear science.

These companies are exhibiting at the Design Engineering Show . . .

	Booth
Aluminum Co. of America	2032
Ampco Metal, Inc.	1612
Armco Steel Corporation	725, 726
E. I. du Pont de Nemours & Company (Inc.) Film Department	1413
Handy & Harman	1715, 1717
Haynes Stellite Co., Division of Union Carbide Corp.	1408, 1412, 1420
International Nickel Co., Inc.	1815, 1819
Kaiser Aluminum & Chemical Sales, Inc.	2005, 2007
Kennametal, Inc.	1305
Linemaster Switch Corp.	1224
MacLean-Fogg Lock Nut Co.	1121
Metal & Thermit Corp.	332
National Tube Division, United States Steel Corp.	2104, 2106, 2112
Ohio Seamless Tube Division, Copperweld Steel Company	629
Raybestos-Manhattan, Inc.	1810, 1812
Republic Steel Corp.	2131
Syntron Company	2105, 2107
United States Steel	2104, 2106, 2112
Welding Design & Fabrication	1111

International Acetylene Association meets in May

SAN FRANCISCO: Safe practices in the use of oxy-acetylene processes and equipment, acetylene for chemicals, and cryogenics will be the principal subjects of technical sessions at the 1960 annual convention of the International Acetylene Association to be held here at the St. Francis Hotel on May 9th and 10th.

The sessions, which will be moderated by outstanding members of the gas and chemical industries, will include speakers from various participating companies, as well as public officals and representatives from the educational field. In announcing the topics for the technical sessions, L. L. McBurney, IAA president, pointed to the selection of cryogenics for this year's program.

"With the current interest in missiles and rockets," McBurney said, "the entire subject of cryogenic fluids and engineering should provide most fertile ground for the Association's investigation and discussion."

Highlight of the two-day San Francisco meeting will be the Morehead Medal Dinner to be held on May 10th. Presentation will be made to this year's recipient of the Association's annual award for advancement in the industry or the art of producing or utilizing calcium carbide or acetylene.

Chairman of the committee in charge of arrangements is E. A. Daniels, vice president in charge of sales, Victor Equipment Company, San Francisco.

About IAA

by L. L. McBurney

president
International
Acetylene
Association

36-92-98-01-60

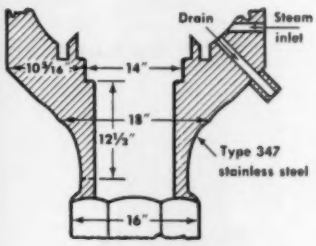
No, this is not an echo from a football team at an early spring practice session, nor is it the combination to the office safe. It is simply an abbreviation for one of the country's oldest technical societies, the International Acetylene Association.

Discovery of acetylene, credited to Sir Edmund Davy, Professor to the Royal Dublin Society, occurred in 1836. Not until 1892, however, was a practical method of manufacturing calcium carbide, from which acetylene gas is derived, developed on a commercial scale. Barely six years later, in 1898, a few far-seeing men organized the International Acetylene Association, devoted then to the promotion of good engineering in the construction of acetylene generators and safety in the use of acetylene in lighting.

A few years later, in 1901, acetylene and oxygen were combined in an experimental model of the first successful oxy-acetylene torch for use in joining and severing metals. Use of acetylene for this purpose gradually displaced lighting as the primary application. New technical and safety problems were presented as a consequence and the IAA became, and has since remained, a clearing house for interchange of information about these problems.

continued on page 83

Profit through E.A.I. Research



Uniform, through-and-through heating of the thickest sections of the big stainless steel valves was provided by the Smith-Dolan method, with precision control of temperatures (2-hour dwell at 1900°F.). Drawing shows cross-sectional dimensions.

Standard Smith-Dolan units come equipped with eye hooks and wheels for easy portability, and with instrumentation for recording permanent charts of the heat run.

SMITH-DOLAN
On-the-Job HEAT TREATMENT

Solution to Weld Embrittlement Problem at Consolidated Edison

Public utilities are among the largest users of the Smith-Dolan System of Low-Frequency Induction Heating. They want to keep their service uninterrupted, their costs low, and they find that this portable system simplifies the problem of pre-heating and post-annealing in producing sound welds, and in making dependable repairs.

A typical application of the system by a public utility was described in a recent article in Welding Design & Fabrication.* At Consolidated Edison's No. 10 Turbine Generating Station in New York City, two large steam pressure valves made of Type 347 stainless had to be repaired because of weld embrittlement. Removal to the shop for heat treatment would have proved costly and time taking. With the Smith-Dolan portable units, the work was completed on the job within 12 hours.

Learn about the savings and other benefits your company can obtain from the Smith-Dolan System. It is today's most versatile heat treating method, simplifies and upgrades work quality in numerous applications. Write for brochure, "Smith-Dolan System of Low-Frequency Induction Heating."

***Reprints available without charge**

Rental Against Purchase — Get first-hand proof in your own plant without capital investment.

DEMAND THE BRAND MADE BY PEOPLE WHO BUY YOUR PRODUCTS

Electric Arc, inc.
152-2 Jelliff Ave.
Newark 8, New Jersey

ELECTRIC-ARC

For More Information Circle No. 86 on Reader Service Card.

1ST

IN

QUALITY

AND

PRODUCTION

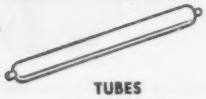
HARRISBURG CYLINDERS

Because Harrisburg Steel has never settled for anything less than the best in quality controls and production methods, the service life of their gas cylinders, which is usually over 30 years, has become the basis of standards for the industry. No other cylinder manufacturer can make this claim for only Harrisburg and Taylor-Wharton, both divisions of Harsco Corporation, have made cylinders for over 30 years.

More than a Century in Harrisburg 25, Pa.

H HARRISBURG STEEL CO.

Division of HARSCO CORPORATION



TUBES

TRANSPORTS

FLANGES

COUPLINGS

For More Information Circle No. 29 on Reader Service Card.

OSU Holds Conference On Welding Engineering

COLUMBUS, OHIO: Ohio State University is offering a summer conference course in the fundamentals of welding engineering from June 13 through 24. The intensive two-week program is intended to help meet the educational needs of management, engineers, production supervisors and technicians employed in the application of welding. The course content and procedures will be similar to those used in a course given last year.

No specific prerequisite training or experience is required for the course. Registration fee is $175.00.

Complete details can be obtained by writing William L. Greene at the Department of Welding Engineering, 190 West 19th Avenue, Columbus 10, Ohio.

COMING EVENTS

May 5-7: Annual Convention, National Welding Supply Association, Palmer House Hotel, Chicago.

May 9-10: Annual Convention, International Acetylene Association, San Francisco.

May 9-13: 2nd Southwestern Metal Congress and Exposition, American Society for Metals, Dallas, Texas.

May 23-26: Design Engineering Conference, Machine Design Division of ASME, New York City's Coliseum.

October 13-15: Western Welding Technical Conference and Welding Show, Santa Clara Valley Section, AWS, San Jose, Calif.

October 17-21: 42nd Annual National Metal Show, American Society for Metals, Philadelphia.

Harris Calorific Forms Mexican Company

CLEVELAND: Clarence M. Taylor, president, Harris Calorific Co., has announced the formation of a new company to be known as Harris De Mexico, S. A., with general offices and manufacturing facilities in Mexico City. All major Harris products in the gas welding and cutting field will be manufactured and distributed in Mexico by this company.

more news on page 82

Do EVERY grinding job better

From lightest to heaviest work, Norton wheels bring you profit-boosting performance

Norton portable wheels include all standard types, as well as the increasingly popular reinforced types. All are engineered for maximum strength, safety and versatility. All are built to *hug that work*, with less vibration and bounce.

In straight, cup and cone types you can get 44 ALUNDUM abrasive and the B-11 resinoid bond. "44" is non-premium priced, cutting faster, grinding cooler and lasting longer than similarly priced aluminum oxide abrasives. B-11 resinoid wheels are more uniform in structure, better balanced, made to closest duplication and available in half-grade increments across the entire hardness scale.*

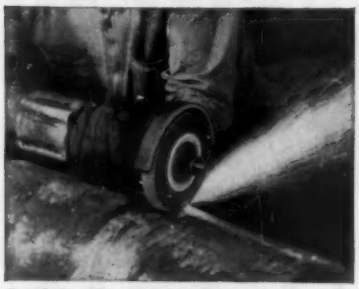
Among the various Norton reinforced wheels, the rigid Type BDA and semi-flexible Type BFR are an unbeatable team for usefulness. Separately, each handles many grinding jobs. Together, they cover an almost endless list of applications.

Ask your Norton Distributor how these fast, tough wheels can benefit every grinding job you do. Or write to NORTON COMPANY, General Offices, Worcester 6, Mass. Plants and distributors around the world.

*Trade-Mark Reg. U.S. Pat. Off. and Foreign Countries

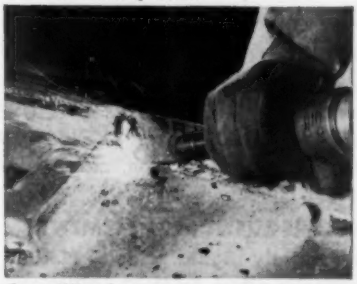
NORTON
ABRASIVES

STRAIGHT–CUP–CONE WHEELS



Straight Wheel makes short work of smoothing a heavy weld.

Flaring Cup Wheel (available with built-in reinforcement in size 6/4¾" x 2") saves time and work on many welds.



Cone Wheel is easier to use in hard-to-reach spots like this.

REINFORCED WHEELS – RAISED HUB

The Rigid Type is ideal for heavier weld grinding, smoothing flame-cut edges, slotting, notching, cutting-off, etc. Reinforced with glass cloth and Nylon.

The Semi-Flexible Type excels in light weld grinding, removing scale, blending contours, scarfing and beveling before welding. Reinforced with cotton fabric and Nylon.

W-1947

Making better products . . . to make your products better

NORTON PRODUCTS: Abrasives • Grinding Wheels • Grinding Machines • Refractories • Electro-Chemicals — BEHR-MANNING DIVISION: Coated Abrasives • Sharpening Stones • Pressure-Sensitive Tapes

For More Information Circle No. 52 on Reader Service Card.

Use a PLASTIC filter for Arc Welding?

NO! NO!

• Until now, the answer has been emphatically *no!* But for the first time anywhere, a plastic plate is available that will filter the harmful ultra-violet and infrared rays of arc welding—and filter them to the same degree as the rigid standards set for glass in Federal specifications. Years of research have resulted in CESCO's new **PLASTI-WELD*** filters, which give arc welders these unusual advantages:

LARGE WINDOW AREA

In addition to the standard size 2″ x 4¼″, PLASTI-WELD FILTERS may be used in CESCO 401-16 and 403-16 helmets. These give 77 square inches of viewing area, *curved* for panoramic vision.

LESS FREQUENT REPLACEMENT

The slightly higher price of PLASTI-WELD filters is greatly offset by their ability to outlast glass, *as much as 6 to 1.* Less breakage from dropping, impact or thermal shock.

HIGHER VISIBILITY

Comments from hundreds of welders who field-tested PLASTI-WELD filters state that they give "unusual clarity—sharper definition of outline." Result: better output, higher quality work.

LIGHT WEIGHT

The 2″ x 4¼″ PLASTI-WELD filter, encased in its own rubber gasket, weighs less than one ounce, compared with two-and-a-half ounces for the average glass plate and cover glass. Regular lens gasket is not required. 7″ x 11″ PLASTI-WELD filter weighs only four-and-a-half ounces.

CESCO

FOR MORE INFORMATION about CESCO PLASTI-WELD filters, contact your nearby CESCO distributor or write our Chicago office

*Pat. Pending

CESCO FOR SAFETY

CHICAGO EYE SHIELD COMPANY • 2711 West Roscoe Street, Chicago 18, Illinois

For More Information Circle No. 14 on Reader Service Card.

NEW

The Portable, Indispensable HOTBOX

WELDING ELECTRODE MOISTURE STABILIZER

HOTBOX is an insulated, electrically heated, thermostatically controlled container designed to maintain welding electrodes at factory specified moisture content. Electrodes kept in the HOTBOX will not be contaminated due to moisture, are kept in ideal condition for either field or shop requirements. It is ruggedly constructed for everyday use; carries a full one year's warranty for your protection. HOTBOX reduces waste, increases production through better weldments, less defects.

HOTBOX operates on 115 V, AC or DC current, holds 50 lbs. of electrodes, maintains temperatures thermostatically at 215°F (±5°).

During production welding, lid may be left open for easy access without affecting electrode temperature control.

Under adverse outside conditions the HOTBOX really pays off by keeping electrodes handy and in condition for best welding results.

How Much Are Welding Defects Costing You?

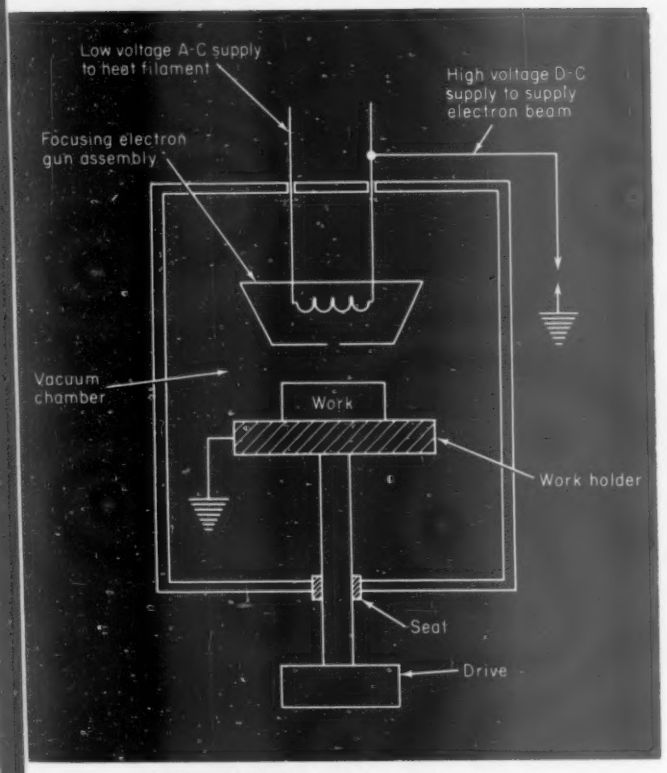
The HOTBOX moisture stabilizer eliminates many causes of improper welds, excessive cleaning and weld replacement. Proper moisture control can reduce surface and under-bead cracking, hidden porosity, splatter, field failures and weld replacement; HOTBOX saves scrapped electrodes and valuable time. The cost of HOTBOX for each of your welders will be amortized in an amazingly short time through savings in scrap loss alone.

Choice area franchised dealerships are available on an exclusive basis to those who qualify. For information, write:

TRADE MARK
CORPORATION • 1500 WEST THIRD AVENUE
COLUMBUS 16, OHIO

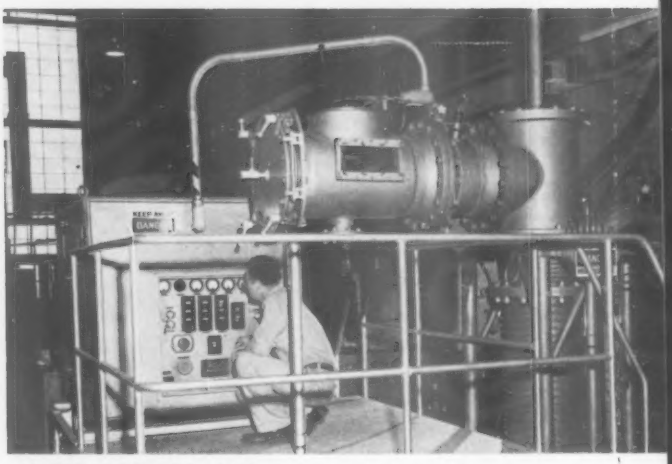
For More Information Circle No. 73 on Reader Service Card.

COVER STORY



BASIC ELEMENTS of an electron beam welder.

ALLOYD RESEARCH CORP. has this lab facility.



AIR REDUCTION COMPANY'S electron beam welder.

Electron Beam Welding: Strong, Ductile Welds

IN BRIEF: High temperatures and physical and electrical impact of high-energy electrons melt out impurities which are attracted by and adhere to the electron gun.

ELECTRON-BEAM WELDING is fast becoming important. It can be used to weld the active metals (beryllium, molybdenum, titanium, zirconium, columbium, tantalum, tungsten and hafnium) as well as aluminum, stainless and carbon steels.

A beam of high-speed electrons strikes the work in a concentrated area. It creates a very high temperature and makes a fusion weld. A high vacuum keeps ionizing particles out of the beam's path and prevents arcing to the work. This vacuum makes the process ideal for ultrahigh purity welds in the highly reactive metals which oxidize rapidly when welded outside a vacuum or without gas shielding. The high temperatures also make the process useful for welding highly refractory metals, may lead to its use for welding ceramics.

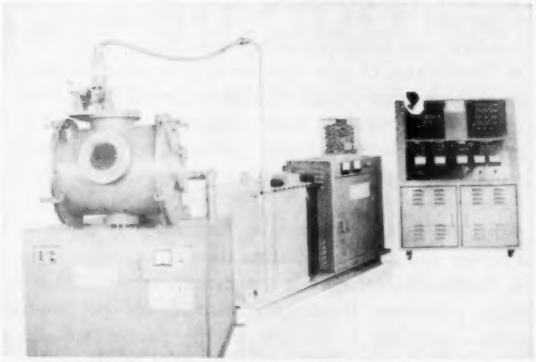
A vacuum of at least 2 x 10^{-4}mm Hg is needed to keep an electron beam from degrading to an arc. At this vacuum, atmospheric impurities in the welding chamber are less than 1 part per million. In actual operation, the level of impurities is even lower, since vacuums of 5 x 10^{-5}mm and even better are the goal.

Welds have exceptional purity, very high ductility, very little crystal growth and small grain size.

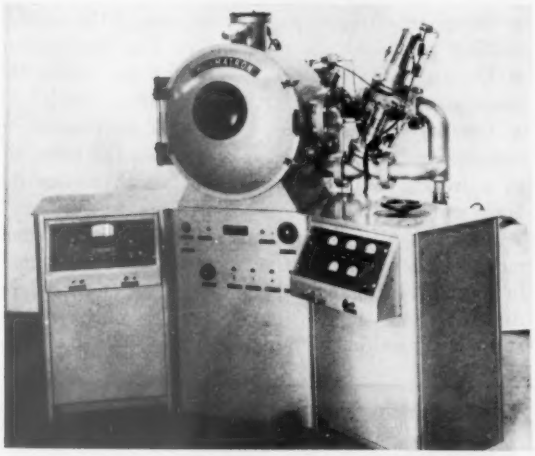
In the active, or exotic, metals there is a close correlation between gas contamination and corrosion resistance. Ductility and strength of welds is closely tied to crystal growth and impurities in the weld areas. The electron-beam produces high-strength welds in these materials because it can cope with contamination and crystal growth.

Electron-beam welders now on the market vary only in detail. They consist of:

- A vacuum chamber in which welding is done.
- A three-part electron gun assembly: A low voltage (25-50 v) AC source to heat the tungsten filament of the gun and provide electrons like a vacuum tube; high voltage (5,000-150,000 v) DC source to propel



SCIAKY BROS., INC., makes this equipment.



HIGH VACUUM EQUIPMENT markets this unit.

In The Active Metals

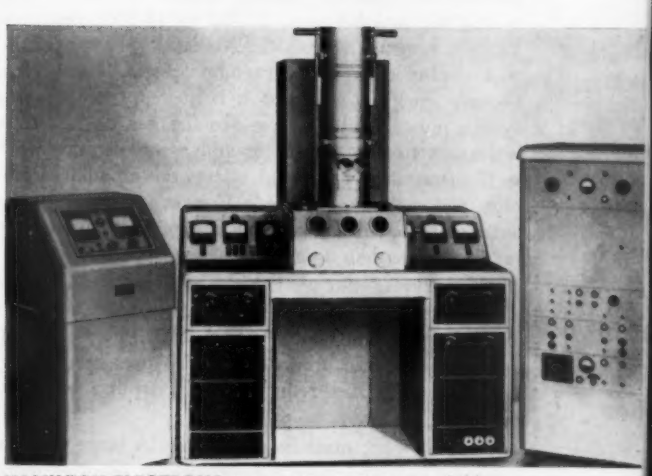
electrons to the work; a focusing device to provide narrow or wide beam as desired.

- A movable work holder, or chuck.
- Equipment to maintain the vacuum.

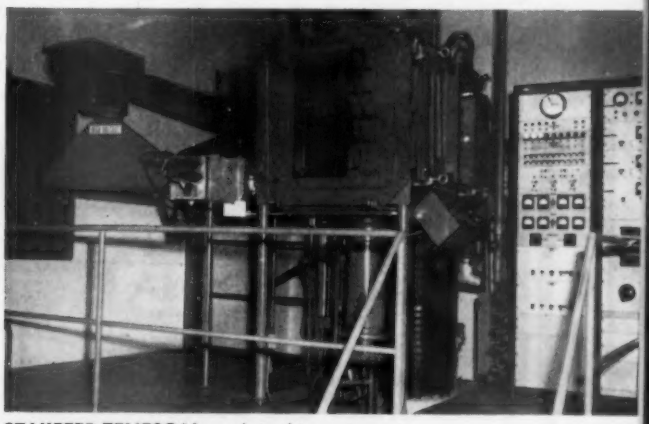
Companies marketing electron beam welders include Air Reduction Sales Co.; General Electric Co.; Hamilton-Electrona, Inc.; High Vacuum Equipment Corp.; NRC Equipment Corp.; Sciaky Bros., Inc.; and Stauffer-Temescal Company. Companies doing research work on electron beam welding include Alloyd Research Corp. and Nuclear Metals, Inc.

Hamilton-Electrona, Inc., the latest entry in this field, was formed to sell in this country the Zeiss electron beam welding and milling machine developed in Germany. The firm's co-owners are the Carl Zeiss Foundation and United Aircraft Corp., whose Hamilton Standard Division will manufacture the machine in this country. A report on this machine will appear in an early issue. • •

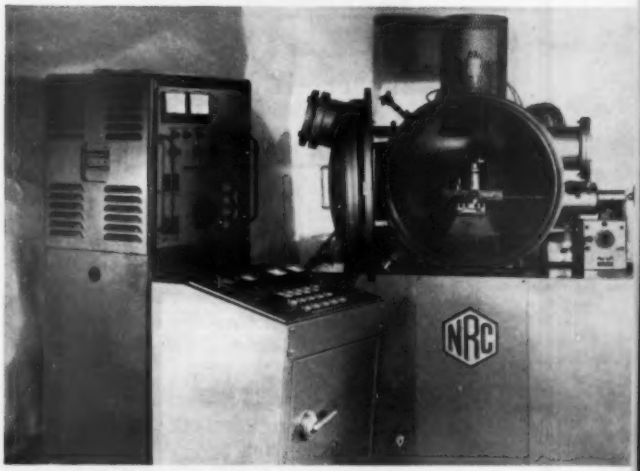
turn the page for a list of 13 things to consider when designing for electron beam welding



HAMILTON-ELECTRONA is newest entry in a new field.



STAUFFER-TEMESCAL markets this equipment.



NRC EQUIPMENT'S electron beam welder.

13 Guides To Designing For Electron Beam Welding . . .

Although much electron beam welding is still on a trial-and-error basis, these guides are available:

- Different materials need different voltages. These are typical: nickel, 5,000 to 7,000; stainless, 6,000 to 15,000; molybdenum, 10,000 to 14,000; tantalum, 12,000; tungsten, 15,000 to 20,000.
- Pumping capacity of vacuum system is important because work out-gasses as it is melted. The pumping system must be able to remove the gas as fast as it is formed to prevent arcing and assure a pure weld.
- Configuration of a weld affects the amount of current and voltage required. For example, a strong butt weld requires more than a lap. In turn, the lap requires more than a light butt.
- Geometry of the work piece governs the distance of the gun from the work. Greater distance calls for higher current and voltage. The designer should keep to a minimum the area of the work presented to the electron beam. This reduces power requirements and heat loss.
- Mass of work must be considered. A large piece is a greater heat sink than a small one. It requires more power to keep it at welding temperature.
- Thickness of work affects the beam size. A lap weld in ⅛-inch stainless steel requires a wide beam to spread the heat over the relatively large area of both plates; on the other hand, welding 0.005-inch stainless foil calls for pinpoint beam focusing.
- Travel rate of gun in relation to work is important. The faster the travel, the more power and energy required. (Actually, most designers have found it practical to keep the gun stationary and move the work, although the beam can be moved laterally by focusing devices.)
- Heat-affected zone can be minimized by using high voltages and short application time.
- Surface cleanliness is not as critical as with some other processes. However, grease should be removed with a solvent. Impurities in the parent metal are floated out of the body and attracted to the welding gun as a sort of frit. The gun is wiped off easily.
- Stress relief is unnecessary because of the narrow welding zone and short period of heat application.
- Design joints so the weld can be run under the beam electromechanically at the desired speed.
- Get the gun as close to the work as possible to reduce required voltage. Avoid shooting the beam into a trench. This creates a field which resists the beam and interferes with proper welding.
- In joining dissimilar metals remember that different metals melt at different temperatures. For example, in joining aluminum to stainless the beam should be directed more at the lower melting stainless than at the faster melting aluminum.

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Hufford Corporation specified all-welded construction for maximum strength, minimum weight

Transporting 80,000 pound rocket engine units and erecting them on test stands requires equipment that is unusual both in design and strength properties. Hufford Division of the Siegler Corporation met this challenging project for Thiokol Chemical Corporation with this mobile handling unit called the Transrector.

The first requirement as a transporter necessitated the use of a minimum weight material for fabrication to reduce the overall hauling load. The use as an erector made strength a highly important factor. This high strength to low weight ratio was achieved through the exclusive use of T1 steel. To retain the inherent strength of T1, the design engineers specified all-welded construction.

Alloy Rods Company's ATOM·ARC "T" more than satisfied Hufford's needs. The only electrode designed specifically to weld T1 steel in all applications, ATOM·ARC "T" weld metal physical properties equal or exceed those of T1 steel in the "as welded" or "stress relieved" condition for 100% design joint efficiency. ATOM·ARC "T" electrodes are also excellent for many other applications where high strength welds are required.

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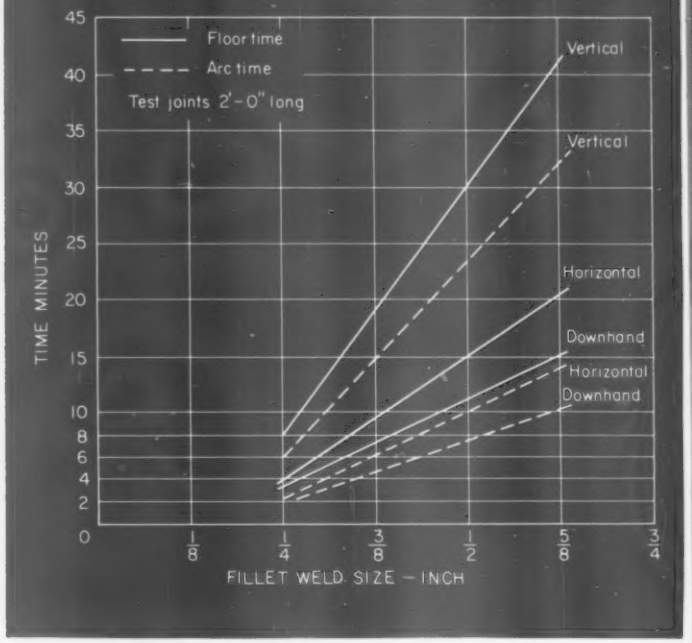
	1/4" FILLET			3/8" FILLET			5/8" FILLET		
	Downhand	Horizontal	Vertical	Downhand	Horizontal	Vertical	Downhand	Horizontal	Vertical
Electrode dia.	1/4	1/4	5/32	1/4	1/4	5/32	1/4	1/4	5/32
Current	360	350	140	360	350	140	360	350	140
Weld passes	1	1	1	1	2	1	3	6	3
Rod changes	2	2	4	3	4	12	7	10	23
Arc time*	1:51	1:54	6:00	4:42	5:46	17:03	10:15	14:37	32:11
Floor time*	3:30	3:15	7:40	6:25	9:24	21:05	15:05	21:45	40:05

*Time in minutes and seconds

from data like this . . .



these welding speed curves. They show . . .

How To Get Better Weldments . . . Faster

By **W. R. EDWARDS**, *Marion Power Shovel Co., Marion, Ohio*

IN BRIEF: There's more to weldments than welding. In this article, the author backs up worthwhile tips on design, fabrication, and welding with useful data on welding speeds.

EVERYONE KNOWS that downhand welds are the best. They also know they can make downhand welds faster than other welds. How much faster is not so well known.

We found out what the difference was by running a series of fillet welds (1/4- through 5/8-inch sizes) in the three positions—downhand, horizontal, and vertical. We made each fillet 2-feet long.

We kept track of arc time with a clock that was hooked up to the welding circuit. We kept track of floor time too. That's how long it takes to change electrodes, raise and lower hood, chip slag, make the weld.

Downhand and horizontal welds were made with 1/4" E-7018 iron powder electrodes; vertical welds with 5/32" E-7016 electrodes (no iron powder).

We used welding currents which we considered the best for the fillet we were making and the position in which we were welding. Actually, the currents used were close to the manufacturer's recommendations.

Besides data on electrodes, current, and time, we kept a record of the number of weld passes and rod changes (see table). Finally we compared the time it took to make different sized fillets in all three positions (see chart).

The curve shows, for example, that if the time for making a 1/2-inch fillet downhand is 100 time units, will take 135 and 275 time units to make the same size fillet in the horizontal and vertical positions respectively.

We would have saved even more time if we had used 5/16" electrodes on the downhand test. The larger electrode can only be used downhand.

These facts lead to some good advice: Position for downhand welding for lowest costs.

Here are some other good rules to follow. They will help keep your weldments economical.

DON'T OVERDESIGN

- Use the smallest welds possible.
- Locate welds so that as many as possible can be made in one position.
- Give the operator room to weld.
- Don't bevel plates unless you have to.

THE MOST WELD IN THE SHORTEST TIME

- Don't overweld.
- Position for downhand welding.
- Use the largest electrode possible.
- Use the highest current you can.
- Use automatic welding.
- Use fixtures.
- Keep welding.
- Watch fitup.

Fitup has a lot to do with weldment cost. Good fitup depends on accuracy—in drawings, templates, and plate preparation. • •

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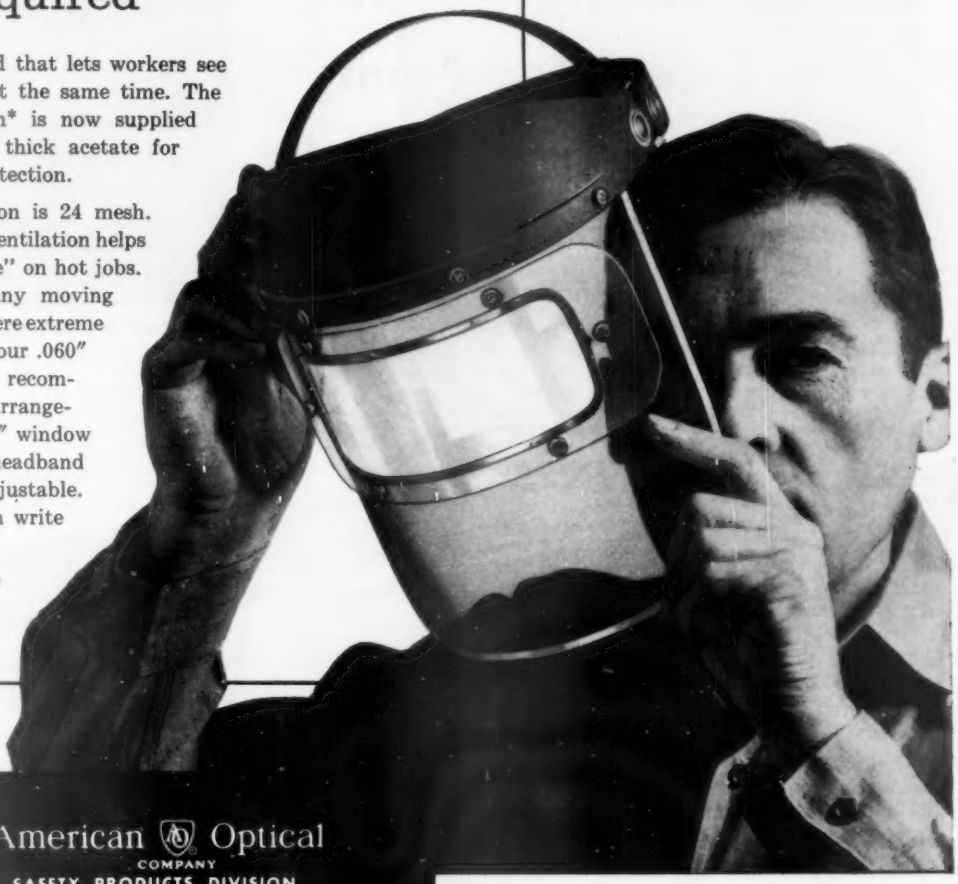
*Smaller than a full size window, it is more economical to replace.



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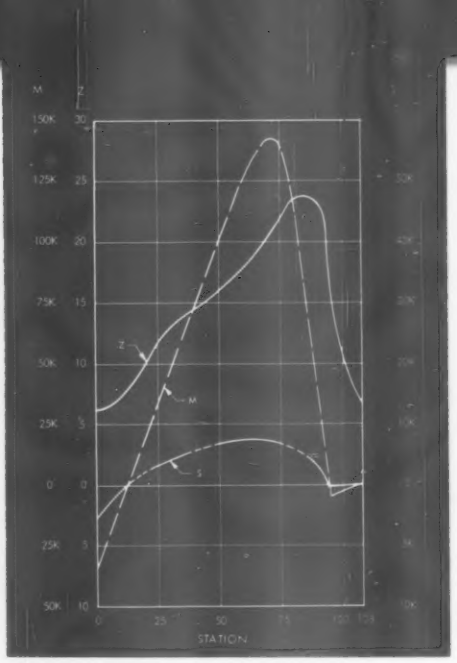
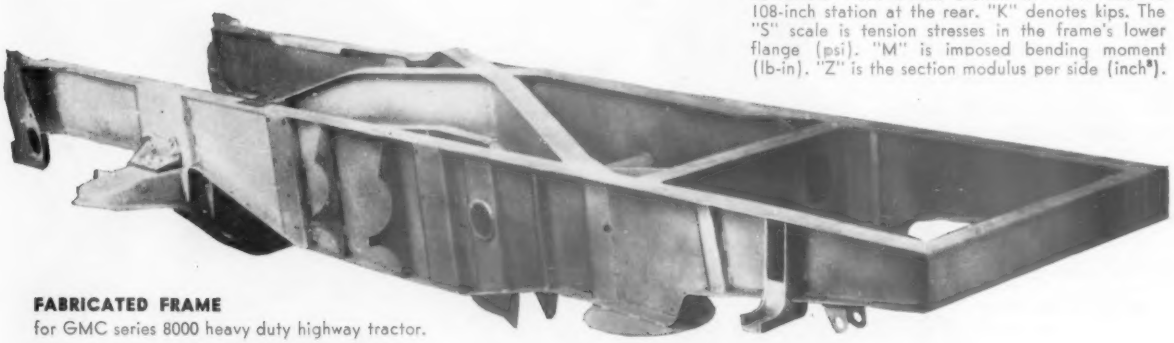
Lighter, Stronger Frame Is Fabricated From High-Strength Steel

by JOHN G. LOCKLIN, and FRANCIS C. FLECK,
Truck and Coach Division, General Motors Corporation



WELDED CONSTRUCTION permits varying frame depth to suit the bending moment and get more uniform stresses. Note comparatively flat stress curve for the frame for static rated load conditions from 0-inch station at front axle to 108-inch station at the rear. "K" denotes kips. The "S" scale is tension stresses in the frame's lower flange (psi). "M" is imposed bending moment (lb-in). "Z" is the section modulus per side (inch^3).



FABRICATED FRAME
for GMC series 8000 heavy duty highway tractor.

IN BRIEF: New type of frame fabricated for highway tractor weighs half as much as conventional channel-type frame; it uses welded I-beam sections as basic building units.

WE WANTED to develop a lightweight Diesel highway tractor with short cab dimensions. By keeping overall weight as low as possible (without sacrificing strength) we got 1,800 pounds more payload.

One place to make weight savings was the truck frame. We replaced the usual channel-type frame with a very deep welded I-beam type construction. The beam has 3/16-inch top flanges continuously welded to thin steel webs. A low-alloy high-strength steel (SAE 950) was chosen. It gives us a frame that weighs 400 pounds less than it would in a comparable channel-type frame made from carbon steel. It gives us high strength and good weldability without high cost.

EDITOR'S NOTE: *Reprinted by permission from the "General Motors Engineering Journal" and copyright 1959 by General Motors Corp.*

WELDED FRAME DESIGN

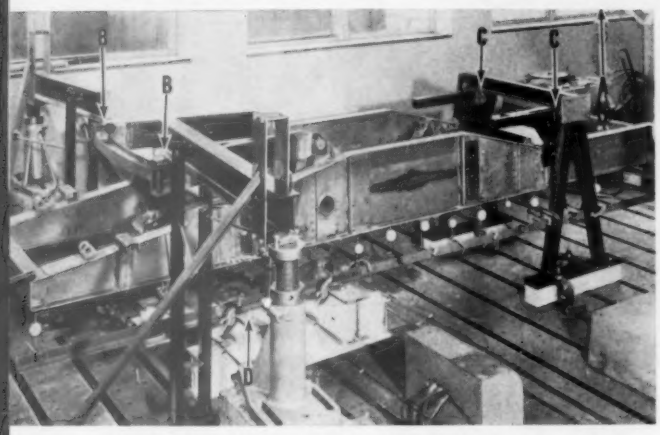
The frame also had to have high beam strength, bending rigidity, and torsional rigidity. We also had to keep to a minimum the tooling needed to fabricate the frame.

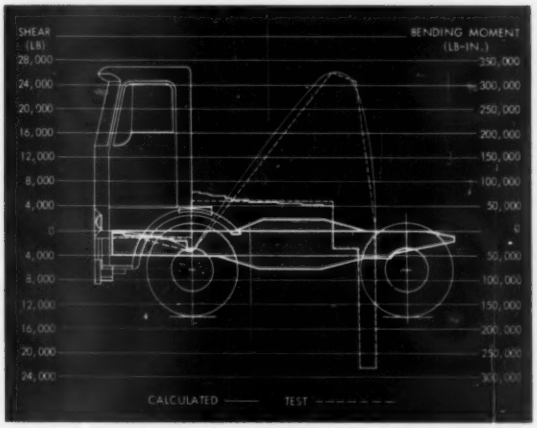
For high beam strength and bending rigidity we made the frame deeper instead of thickening the section as is done with conventional channel rails. We selected an I-section building unit for the frame because its distribution of material was particularly efficient in providing rigidity.

Torsional rigidity was needed to make the high roll rate of the front suspension effective at the fifth wheel where forces from a loaded trailer are concentrated to produce lateral loads. (The fifth wheel, used to attach a semi-trailer to a highway tractor, consists of a base rigidly mounted to the frame and connected through a pivot joint to a plate assembly. The plate assembly incorporates a latch mechanism used to couple or un-couple the trailer.) The inefficiency of the I-section to resist torsional loads was overcome by designing an X-member into the frame assembly. The diagonal members of the X act as beams to resist twisting of the frame.

Welding helped us meet the requirements of mini-

Welded I-beam frame is tested thoroughly . . .





FOR THE 3G VERTICAL LOAD TEST, calculated shear and bending moment diagrams for the frame had to be simulated as closely as possible. The frame above is in the upside down position with the rear of the frame at the left. Loads were applied at "A" and at the two points "B". The load at "A" was located 43.8 inches ahead of the front suspension. This load, which simulated loads ahead of the independent front suspension had a magnitude of 2,850 lb. The load applied at points "B" had a magnitude of 23,282 lb. Points "C" and "D" are reactions. The reactions at points "C", the front suspension location, was 9.114 lb. The reaction at "D", which represented the reaction at the fifth wheel, had a magnitude of 61,941 lb. The deflection of the frame from vertical bending was measured by indicators shown positioned beneath the frame. The vertical stiffness of the frame at the fifth wheel was found to be 10 times greater than on a frame of comparable wheelbase using the standard channel-type side rails.

The diagram shows the close agreement between the calculated (solid line) and test (dashed line) shear and bending moment curves.

mum weight, strength, and rigidity. The stress for a simple beam is found by dividing the bending moment by the section modulus. The modulus varies as the square of the depth of the section, so it saves weight to vary the frame depth to suit the bending moment. Furthermore, since the vertical web of an I-beam contributes the least to the section modulus, we made a thinner web. We set the thickness at 1/16 inch for the vertical web and 3/16 inch for the flange.

The use of high strength, low alloy steel (SAE 950) helped us safely support higher stresses. The minimum yield point of this steel for the thicknesses used in the frame is 50,000 psi. This compares to a minimum yield point of about 31,000 psi for SAE 1023 steel that is commonly used in channel side members for tractor frames. And, we can weld the SAE 950 steel without lessening its strength, as we would if we used heat treated steel.

It was not hard to get by with minimum tooling. We used a combination of relatively simple pieces welded into an assembly. Only a minimum of specially-formed parts were required.

Most of the tooling is in the welding fixtures. About half of the welding is done by an automatic welding machine. Using the flange of the I-beam frame as a guide for positioning the welding head, it welds the flange to the web smoothly, accurately. We use the inert gas arc welding process because it is fast and gives us excellent penetration and sound welds.

Our design yields other manufacturing advantages. The frame assembly can be made from flat pieces, so the parts for the frames do not require special storage areas or special handling equipment.

DESIGN RESULTS

The weight of the new frame is half that of a comparable channel frame. It has 27.8 times more torsional stiffness and 1.6 times more beaming stiffness than a conventional channel frame assembly.

The I-beam frame has a frame torsional rate of 8,350 lb-ft per degree of twist. This compares favorably with the 600 lb-ft per degree of twist for conventional channel frames.

ELABORATE TESTING PROGRAM

We tested the fabricated I-beam frame with unusual thoroughness because it was so different.

We subjected a test frame to:

- 3G vertical loading
- 1G vertical loading with 0.8 coefficient of friction brake stop (taking into account weight transfer)
- torsional loading
- 1G vertical loading with 0.5G lateral loading

SIMULATED FRAME LOADS

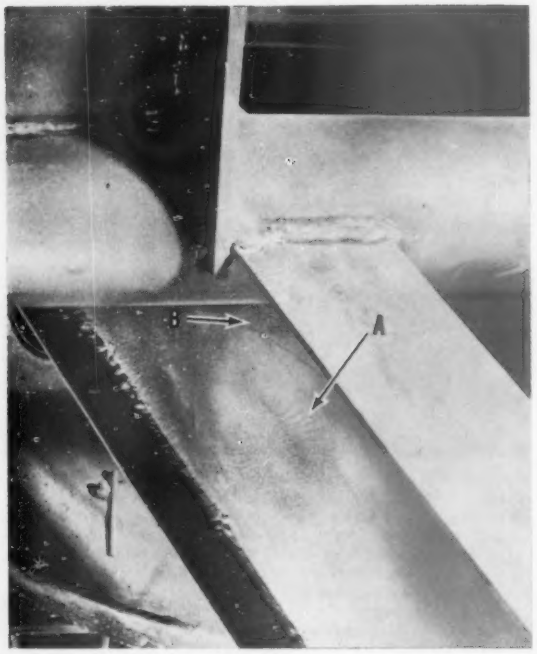
In the early stages we established the static load capacities for the front axle of the tractor (11,000 lb) and the rear axle (18,000 lb). The rated gross combination weight (tractor, trailer and load) was to be 61,000 lb. We calculated the loads on the axles for the 3G vertical loading at 33,000 lb. for the front axle and 54,000 lb. for the rear.

We had to make extensive tests to simulate actual conditions of shear forces and bending moments. Our calculations showed us we could simulate them.

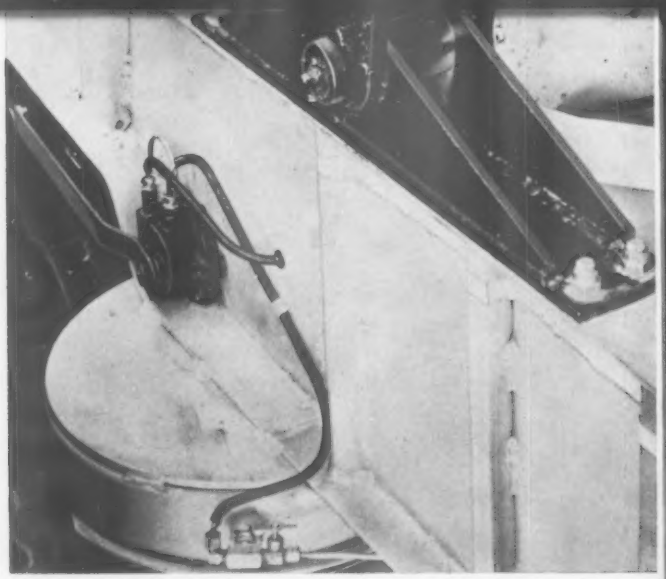
STRESS ANALYSIS

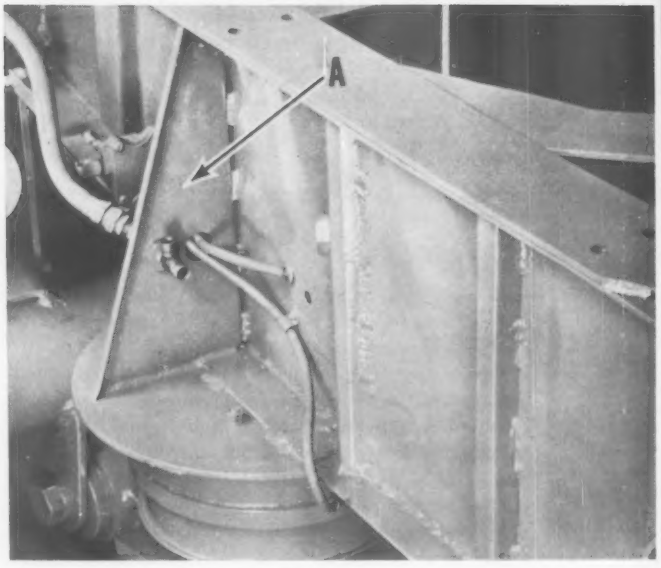
At the start of our lab tests we took a series 8000

FABRICATED FRAME *continued*



IN BRITTLE LACQUER technique (above) ionized powder is sprayed on the lacquer to intensify stress cracks. This makes it possible to photograph all major stress concentration crack patterns for permanent record. The large crack pattern (A) shows buckling in the center of the web. The crack pattern (B) is stress concentration. Both patterns appeared at the ultimate lateral loading condition. Since the stresses in these areas were below the yield strength of the material, and the conditions at which the stress cracks occurred could not be considered of a fatigue nature, no design changes were made in the structure.





CERTAIN DESIGN CHANGES resulted from static tests made on the frame in the laboratory. For example, it was found that high stresses were caused by the overhang of the rear air spring relative to the centerline of the frame side rail (right, top). This resulted in local torsional deflection of the bottom flange of the frame. To eliminate this deflection a brace (A) was added (right).

tractor test frame that had only the web stiffeners only where they were needed to act as brackets for supporting components: fuel tanks, air tanks, etc.

We decided that if additional stiffeners were to be added we could position them during testing of the frame under load. We used the brittle lacquer technique to locate the region of web buckling and then placed a stiffener in such a manner as to resist it.

We used the brittle lacquer technique throughout the test program for a qualitative analysis of the stresses and to locate stress concentrations. We knew from experience that a large and intricate part makes it impossible to pinpoint maximum stress, and its direction.

For quantitative analysis, we used strain gages. We obtained a true reading by applying them at right angles to the direction of a crack pattern. We made a tape record of each increment of loading for each load condition was made. Plotting the stresses showed us any sudden increases in the measured stress, if some portion of the metal adjacent to the gage had yielded, and if the part to which the strain gage was attached had to carry additional loading.

DESIGN CHANGES

The 3G vertical loading condition showed high stresses in the area where the rear air spring attached to the frame. They were caused by the air spring overhanging the centerline of the frame side rail. The bottom flange of the side rail deflected torsionally. We cured this by adding a brace.

The 1G vertical loading test with the 0.8 coefficient of friction brake stop showed there were stresses in the area where the front independent suspension crossmember attached to the frame side rails. These stresses were caused by the crossmember trying to deflect, since all braking loads were transmitted from the crossmember to the side rail through brackets at the flange. We increased the web thickness to 0.1046 inches. • •

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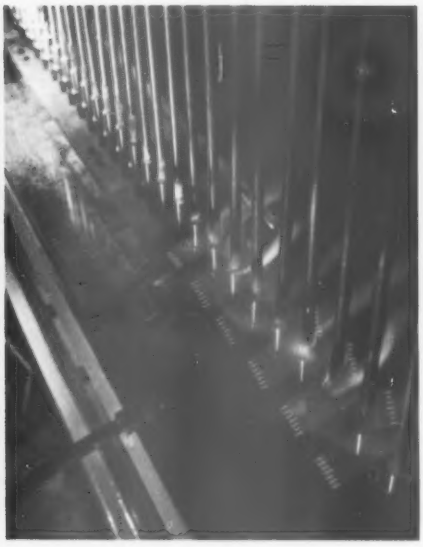
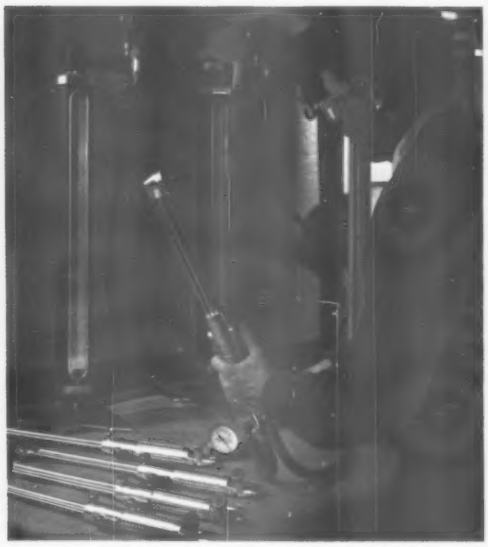


The royal blue flames of automatic gas brazing make strong, smooth, uniform joints in Airco torches. This machine brazes parts in brass, bronze, copper and stainless steel.



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Tips must test out at top quality, also—every one is tested separately for accuracy of hole alignment and stability of gas flow.

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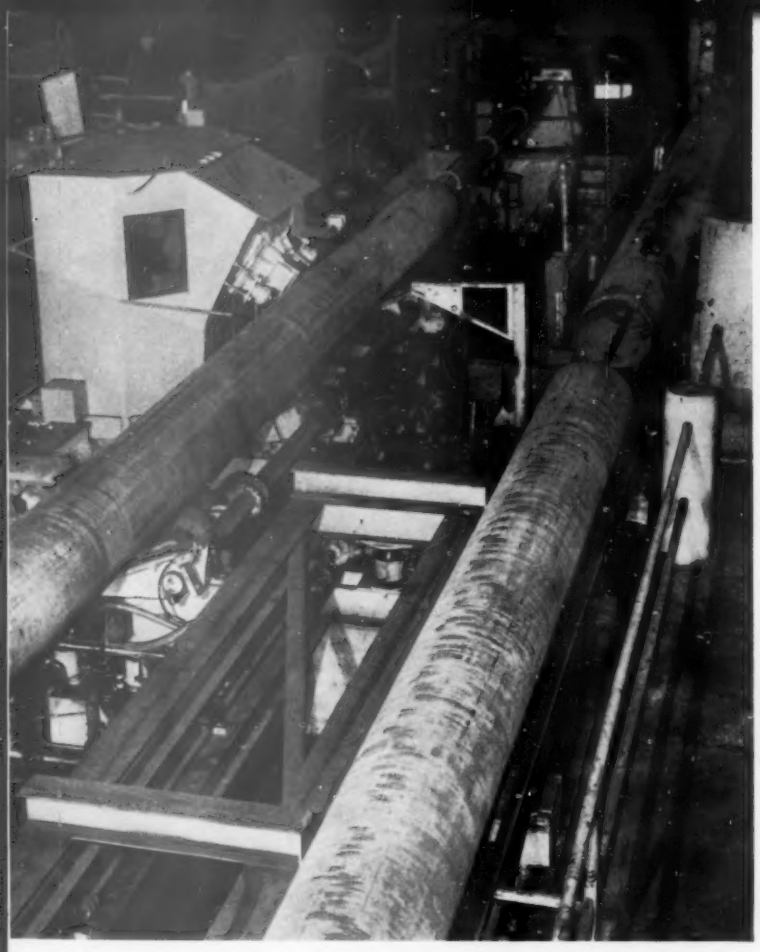

40-FOOT SECTION of welded steel pipe passes before fluoroscopic inspection booth at National Works of U. S. Steel's National Tube Division (left). An inspector inside the white booth watches a television screen where a fluoroscope picture of the submerged arc welded seam is projected. The picture is taken by an X-ray head placed inside the pipe (above).

Continuous Fluoroscoping Speeds Inspection Of Submerged Arc Welded Line Pipe

IN BRIEF: U. S. Steel uses fast, efficient fluoroscopy to check the entire length of each weld in large diameter pipe for oil and gas transmission lines.

CONTINUOUS FLUOROSCOPING finds defects in welded steel pipe at the National Tube Division of United States Steel. The National Works at McKeesport, Pa., uses this nondestructive test on large diameter pipe made for oil and gas transmission lines. According to L. F. Sattele, the general superintendent, the continuous fluoroscoping machine has been working satisfactorily on a production basis since January, 1959.

Problem: Mr. Sattele explains that they used to inspect submerged arc welds by X-ray. Only the end portions on each pipe section had been examined. X-ray inspection was slow, even for this limited area, because X-ray film had to be positioned and developed.

Solution: Continuous fluoroscoping of the entire length of each weld is quick and efficient. Flaws are easy to find because they show up sharply.

How it's done: The fluoroscope has an X-ray head. This head casts a shadow image of a weld on the fluorescent screen. Electronically, the image is intensified and picked up by a television camera. An inspector examines the greatly enlarged televised picture on a television monitoring screen.

A carriage moves 40 foot sections of welded pipe past the inspection booth. The X-ray head, mounted on a 48-foot boom, fits inside the pipe and lines up with the welded seam. The image is projected on the fluorescent screen as the pipe moves past the booth.

Inside the booth, an inspector stands at a control panel. With this, he positions the pipe and controls its lateral movement. He can slow the carriage or stop it instantly to examine any part of the weld more closely. The inspector marks flaws by spraying water-soluble white paint on them. He simply presses a button to do this. • •

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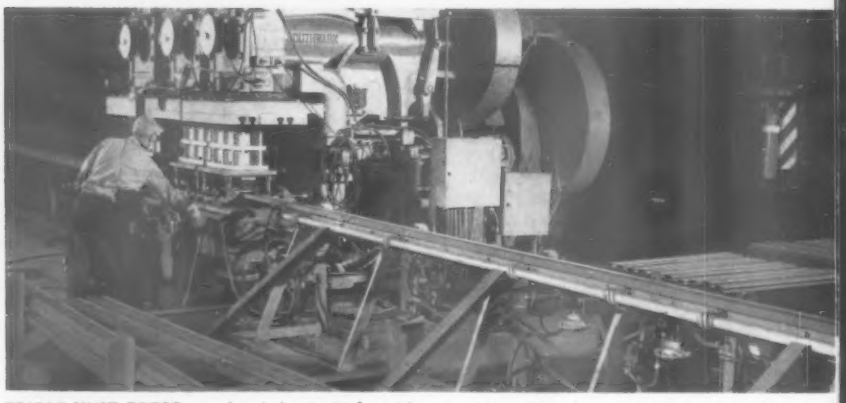
MOBILE HYDRAULIC CRANE positions floor grating panel. Panels are made of 10 modified I-beam sections and 36 transverse bars with dumbell section.



TRIPLE-UNIT PRESS punches holes in 26-foot I-beams at 8 to 9 inch spacing. Press is tied in to automatic air-power roll feed and unloader.

Highway Bridge Floor Panels Are

IN BRIEF: Careful integration of punching equipment, material handling, fit-up and welding procedures was needed to do a good job on 700 bridge floor grating panels which weigh 4,000 pounds and measure 7½- by 26-feet.

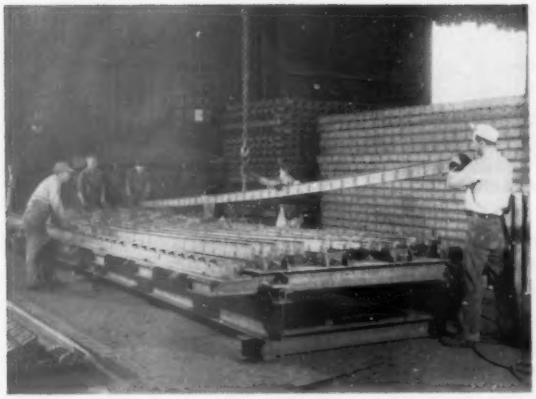
THE GREATER NEW ORLEANS BRIDGE over the Mississippi has 700 floor grating panels. Each weighs about 4000 pounds and measures 26 x 7½ feet. Special efforts in integration of equipment, material handling and arc welding procedures were needed to do a good job. That's what the engineering department of Blaw-Knox Co., Pittsburgh, Pa., did to meet tight delivery requirements. The grating floors the longest cantilever span in the United States, the third longest in the world.

GRID FLOORING

The grid flooring forms the subsurface of the main span, 1575 feet long and one of the anchor spans, 853 feet long. (The shorter 591 foot anchor span is floored with concrete slabs to balance weight distribution.) Roadway approaches to the bridge total 9100 feet in length. That makes the entire installation nearly 2½ miles long. The roadway is 52 feet wide. It is flanked by two 3-foot walks.

FLOOR PANEL

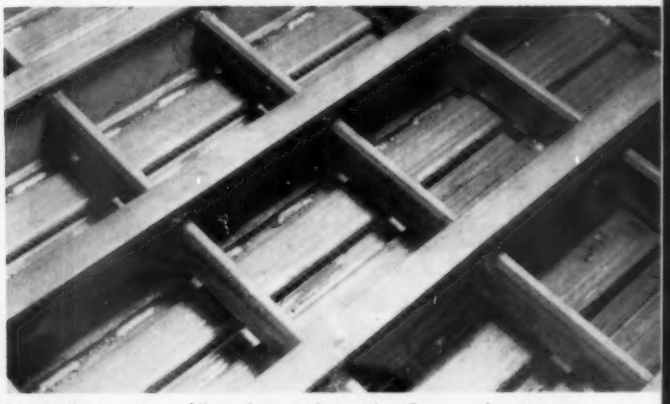
Each floor panel is made of 10 longitudinal beams. They are of modified I-section 5-inches deep with 1-inch thick flanges on top and 1½ inches on bottom. The webs of these lengthwise beams are punched at 8- to 9-inch intervals to receive 2¾ inch transverse bars of dumbell section. It takes about 36 of these bars for a panel, making 360 separate intersections to be arc welded. They're welded around the top and bottom bulbs of the dumbell and both sides of the web. A special welding fixture hold the grid rigidly during welding.



I-BEAMS are positioned on 9-inch centers in welding fixture (above) before transverse bars are slid through punched holes

(above). Camber in beams compensates for distortion during welding.

THREE OPERATORS use iron powder electrodes to make welds (above). Finished grating (right) shows welds around dumbell



bars and intermittent fillets along sealing strips. Depressed part of strip is welded to cross bars.

Designed For Welded Fabrication

ASSEMBLY WELDING

The workers assemble and weld the grid over a sealing pan made of strips of corrugated sheet steel, resembling roofing. They fit the strips in the fixture before the grid is assembled. They weld the strips to the longitudinals and the crossmembers. The strip sections are shaped so that the depressed portions in the center rest on the dumbell bars and the raised edges bear against the longitudinals. The purpose of the sealing pan is twofold: it strengthens the structure, and makes it more rigid, and it holds the bituminous concrete surfacing that forms the road. The steel panel weighs 20 pounds per square foot. The surfacing material weighs 27 pounds per square foot.

USE SKIP WELDS

The photo shows the welds between the longitudinals and the sealing strips. The welds are of the skip type, intermittent fillets being about 2 inches long and on 4-inch centers. Being in the flat position, the best way to make them was with an iron powder electrode. A 5/32 inch Lincoln Electric Jetweld 1 electrode (AWS E-6024) was used. For welds in other positions, a Fleetweld 37 (E-6013) electrode was used.

FIELD WELDING

Two panels end-to-end and set crosswise, span the 52 foot roadway. They are welded to each other, to the framing, and to the next panel.

WELDING FIXTURES

There's enough shop welding to demand three sets of 28- x 10-foot welding fixtures. About 112 pieces comprising one assembly are positioned and held firmly in the fixture by 70 screw-type hold-down clamps. Blaw-Knox cambered the longitudinals slightly to compensate for distortion after welding. Other devices were built into the fixtures, to control or balance out

continued on page 48

HIGHWAY BRIDGE FLOOR PANELS

continued from page 47

distortion, and to make it easy to handle slightly different widths. They planned the welding sequencing carefully to minimize heat build-up.

FABRICATING

The planners devised an unusual setup for punching the longitudinals. They positioned three idle Baldwin-Southwark 175-ton punch presses in line, fitted piercing dies to them. Then they installed a roll-type feed (powered by an air motor) and an air-operated unloader. Through electrical controls they tied together loading, punching, and unloading. This made the operation nearly automatic. A single switch controlled everything.

Irregular spacing of the holes in the beams required ingenious dies and feeds. The designers wanted the transverse bars oddly spaced to avoid the possibility of resonant vibration.

Completed flooring sections were dipped in a tank of paint. Then they were shipped by barge to New Orleans.

Modjeski and Masters, Harrisburg, Pa., were engineers and designers for the entire bridge structure. Bethlehem Steel Company held the contract for fabrication and erection of the 35,000 tons of steel in the bridge. • •

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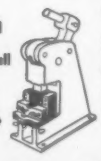

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Adjust-A-Pressure holders (above, left) used with Adjust-A-Angle adapters solve many welding problems; change from one electrode spacing to another — a matter of minutes — with the same set-up.

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How Rocketdyne Saves Rocket Pump Turbine Wheels

by **SCHOLER BANGS**, *western editor*

IN BRIEF: Two bright employees won over $4,000 because they found a way to repair one of the costliest parts of a rocket engine fuel pump—the turbine wheel.

WHEN THE TURBINE WHEEL, one of the costliest parts of a rocket's fuel pump, was damaged, it used to be scrapped. That's been changed. Two bright employees of Rocketdyne, a division of North American Aviation, Inc. found a way to fix them good as new. They devised simple, inexpensive tooling and perfected a method using manual tungsten arc welding.

The new method was so good that Rocketdyne, Canoga Park, Calif., awarded $4,110 to Gene French, production development, and Otis Beaty, turbopump department.

Here are the steps of their method:

PREPARATION:

Remove damaged blades, plus one more on either side, with an abrasive cutoff wheel. The blades are of Haynes Stellite 21 alloy; the hub of Timken 16-25-6 alloy. Contour a welding groove on either side of the wheel with a pencil-grip grinder.

ASSEMBLY:

Fit new blades into the gap, align them, and clamp them between plates. The plates have cutouts that enable the operator to get at the weld.

WELDING:

Weld joint with a tungsten arc torch and Hastelloy W filler wire. Set shielding argon gas at 8 cfh flow and current between 80 and 90 amps on straight polarity. The electrode is a 2 percent thoriated tungsten, 3/32 inches in diameter.

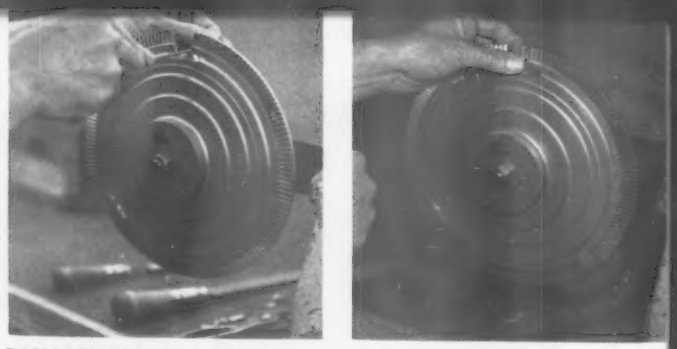
It usually takes eight passes, four on each side of the wheel, to complete the weld. Avoid distortion by welding alternately one side, then the other.

FINISHING:

Grind the weld flush, then polish it. Balance the wheel.

INSPECTION:

Finally, inspect the turbine wheel with a binocular microscope. Watch two things: blade alignment and surface. • •



DAMAGED BLADES (left) are cut out and the joint is prepared to accept new blades of the same material (right).

TUNGSTEN ARC TORCH and Hastelloy W filler wire are used to join clamped and aligned blades to turbine wheel hub.

REPAIRED WHEEL is closely inspected with binocular microscope to make sure blades are true, surface is perfect.

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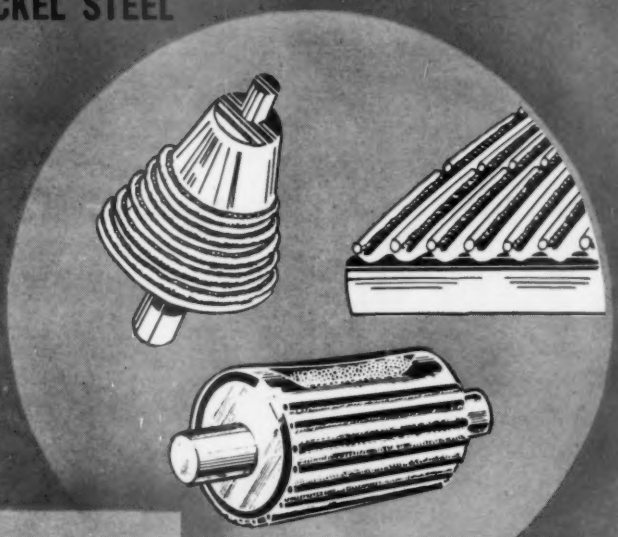

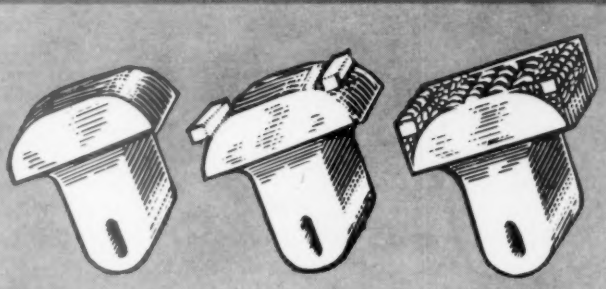

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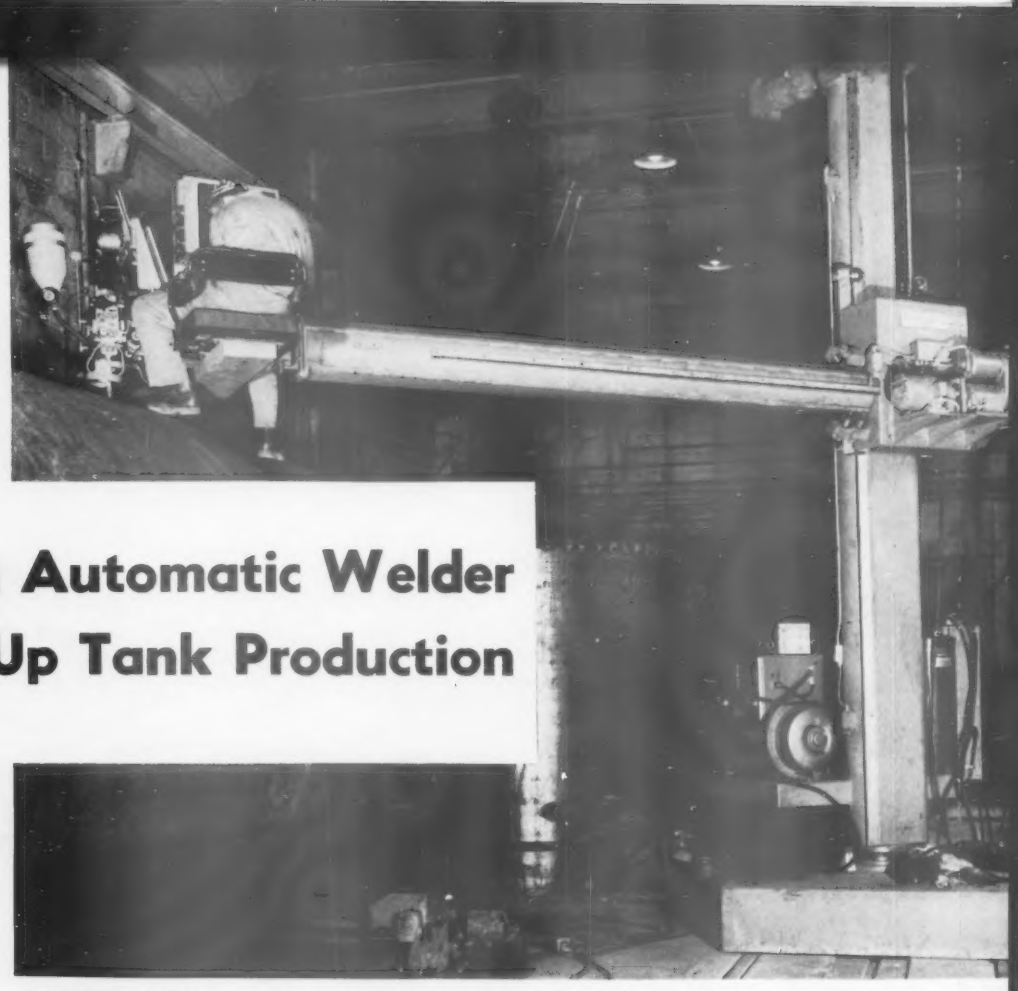
Traveling Automatic Welder Steps Up Tank Production



MOTORIZED BOOM will extend even further than shown—up to 12 feet. Operator controls boom extension and height from his perch, along with travel of the rail-mounted manipulator and all welding functions.

IN BRIEF: A new track-mounted automatic welder is the most important addition in a 5-point expansion program aimed at raising tank production.

A 5-POINT EXPANSION PROGRAM at the Bishopric Products Co., Cincinnati, has given the company all the production it can use.

It has:

1. A new centralized compressed air system.
2. Relocated several departments to reduce movement of material.
3. Expanded the coating plant; added sprayers, ovens and conveyors.
4. Paved the railroad yard to gain space and make loading more efficient.
5. Installed cockpit controlled automatic welding equipment that can range a 1,920-square-foot area.

The last, perhaps, is the most important.

Bishopric fabricates steel tanks as large as 12 feet across and over 50 feet long and other large and small weldments. Its Lastiglas-lined tanks are used widely for beverage and chemical processing.

The welding machine consists of a welding head manipulator mounted on a dolly. The dolly rolls on 80-foot-long rails. The tubular head-holding boom rotates 360 degrees with the column on the dolly. It moves in and out to make a straight-line weld at right angles to the track or can make circular welds at any radius up to 12 feet. The boom has an 11-foot height adjustment; the highest, 14 feet above the floor. The operator controls welding voltage, wire feed, dolly travel, boom movement from his comfortable boom-mounted perch. He can get pinpoint positioning by pushing inching buttons.

Hobart Brothers built the submerged arc welding head, controls, and constant voltage power source used on the machine. The 900-amp-power source, is mounted on the manipulator column along with the flux recovery unit. Control cables to the operator's control panel are inside the boom, out of the way.

A crane travels over the welding bay to position and move weldments. Turning roll sets are spotted in the area served by the welding machine but can be moved to suit the tank being welded.

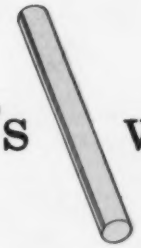
The welding setup is flexible. The machine can weld at any point along the 80-foot track or the full length. While one weldment is set up, another is welded. Several tanks can be welded aternately to let welds cool between passes.

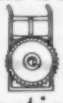
The machine can weld up to 100 ipm. This not only results in high deposit rates, it keeps distortion down by keeping heat penetration low. • •

COMPOSITION OF COMMERCIAL ALLOYS

Anaconda Memo to Management

This is a penny's worth of bronze



It's a piece of Anaconda welding rod that could be worth its weight in gold to you. It might save you a big capital investment or important production time by salvaging equipment that seems beyond repair. Take the experience of Jessup Steel Co., for example. A while back their production stopped dead in its tracks when the 60-ton semisteel base of a big forging hammer fractured. A replacement base? Of course—in nine months. Jessup called specialists in repairing heavy machinery. The base was repaired by braze welding in a week —at 20% of replacement cost. About a ton of Tobin Bronze®-481 rod was used. But sometimes a few ounces can make equally significant savings in building up worn surfaces or repairing a broken part that has immobilized  a big machine. *And don't overlook braze welding in production.* It's a practical way to get flexible, low-cost production assembly of tubular and sheet steel products —like furniture and appliances. American Motors uses it to add strength, prevent squeaks, leaks, and rattles in unit construction of the Rambler's body, supplementing electric welding in some 30 areas. Anaconda-997 (Low Fuming) Bronze Rod has proved to be the best welding rod for these production uses.

We'd be glad to send you (or anyone else in your company) a copy of Publication B-13 which gives detailed and practical information on Anaconda Welding Rods in repair and production jobs. If you have a special problem, the services of an Anaconda specialist are at your disposal. Write: The American Brass Company, Waterbury 20, Conn. In Canada: Anaconda American Brass Ltd., New Toronto, Ont.

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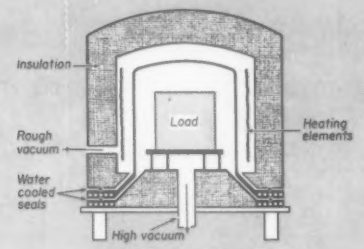
These alloys are difficult to braze in regular furnace atmospheres . . .

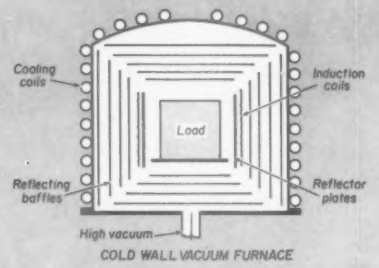
COMPOSITION OF COMMERCIAL ALLOYS

Material Designation	Carbon	Manganese	Chromium	Nickel	Aluminum	Silicon	Iron	Titanium	Others
17-7 ph	.09 Max	1.00 Max	16.00–18.00	6.50–7.75	.75–1.50	1.00 Max	Bal.		
AM-350	.08	.60	17.0	4.2		.40			Mo 2.75
304	.08	18.00–20.00		8.00–12.00			Bal.		
430	.12		14.00–18.00				Bal.		
R235 Nominal	.16 Max	1.00 Max	14.00–17.00		1.75–2.25	1.00 Max	9.00–11.00	2.25–2.75	Mo 4.5–6.5 Co 2.50 Max
Inconel X Nominal	.04		15.00	73.00	.60		7.00	2.40	Cb 1.00

but in these furnaces, better wetting and flow explain . . .



HOT WALL VACUUM FURNACE



COLD WALL VACUUM FURNACE

Why Vacuum Brazing Makes Better Joints

by **R. F. GUNOW,** *Vac-Hyd Processing Corp., Highland Park, Michigan*

IN BRIEF: Many metals are easy prey for harmful gases found in the cleanest of furnace atmospheres. This report tells how vacuum brazing makes better joints because there are no contaminants.

ANY INDUSTRIAL PROCESS has arrived when you can buy equipment for it in any size from 6-inch to 12-foot diameters, and in lengths up to 30 feet. That's the range for vacuum brazing. In these furnaces it is common to braze at temperatures as high as 2,200°F and vacuums down to 0.5 microns.

Why a vacuum? Many metals are easy prey for harmful gases, like oxygen and nitrogen, found in the cleanest of furnace brazing atmospheres. Oxides and nitrides form on the parts being brazed and these films prevent a good braze.

In vacuum brazing there are no contaminants; the parts remain clean. In fact, under certain conditions, the brazing vacuum will remove oxides already on the part.

There are two kinds of vacuum brazing furnaces: cold wall and hot wall (see sketches). A typical hot-wall furnace has heating elements outside the vacuum chamber, the work being protected by the wall. In the cold-wall furnace, the heating elements are inside the vacuum chamber. The cold wall furnace heats and cools the fastest.

The way a metal brazes in a vacuum is affected by surface reactions and the pressure of the gaseous reactants. Elements of commercial alloys form compounds that effect vapor pressure as well as the surface oxides. At high temperature a vacuum drives surface reactions by reducing the pressure of the gaseous elements.

The microstructure of an alloy's surface layer also affects the way alloy constituents vaporize. We made thorough metallurgical studies of oxide behavior on type 430 stainless and pure chromium in a high temperature vacuum. We found:

► Commercial alloys form oxides that act differently than those of pure metals.

► Preventing or removal of oxides in vacuum depends on the microstructure of the metal.

► Removal of oxides in vacuum depends on the type of oxide and not alone on the alloy constituents.

► Oxide films of many commercial metals can be removed by vacuum thermal treatments.

WETTABILITY AND FLOW ARE IMPORTANT

Good brazing depends on the brazing alloy wetting the joint. In vacuum brazing, wettability and flow depend on the surface reactions. We compared the wettability—in hydrogen and in vacuum—of a standard nickel brazing alloy, AMS 4777, on some commercial high temperature alloys. We picked alloys that are hard to braze in hydrogen, with high (over 1.5%) titanium and aluminum contents. Wetting and flow were better in vacuum.

For the hydrogen brazing, we flowed low dew point gas freely over the surfaces. This isn't always possible in practice; parts aren't shaped to permit free flow. There are frequently pockets of high dew point hydrogen. When the dew point exceeds —40°F on stainless, for example, wetting and flow are poor.

Besides improving wetting and flow, vacuum brazing makes stronger joints than are possible with salt and with hydrogen brazing. In one test, vacuum increased shear strength 50 percent.

You cannot vacuum braze all alloys. At high temperatures alloys such as high beryllium copper and high aluminum-titanium iron base alloys form films that impede wetting and flow. To prevent this, ultra-high vacuums are required.

You can't get around these films by using liquid fluxes; they won't work in a vacuum. But sometimes getters will.

Getters react with gases like oxygen and nitrogen and remove them. Like gaseous fluxes, they promote the wetting and flow of the brazing alloy. Active materials like lithium, sodium, potassium, calcium, titanium, and barium are used for getters.

High melting point getters, titanium for example, are fed automatically as wire into the chamber where they evaporate. After removing the gases, the metallic vapors condense on the cold walls of the chamber.

Alkaline metals can be evaporated either from a cup in the heating chamber or evaporated electrically in the cold zone. Electrical evaporation controls quantity best and allows the getter to be programmed during brazing.

There are disadvantages to getting with alkaline metals. The excess collects in the cold lines and chambers. Later, when the chamber is opened, the material picks up moisture and forms a caustic coating. Also, a reaction between the getter and the work must be avoided.

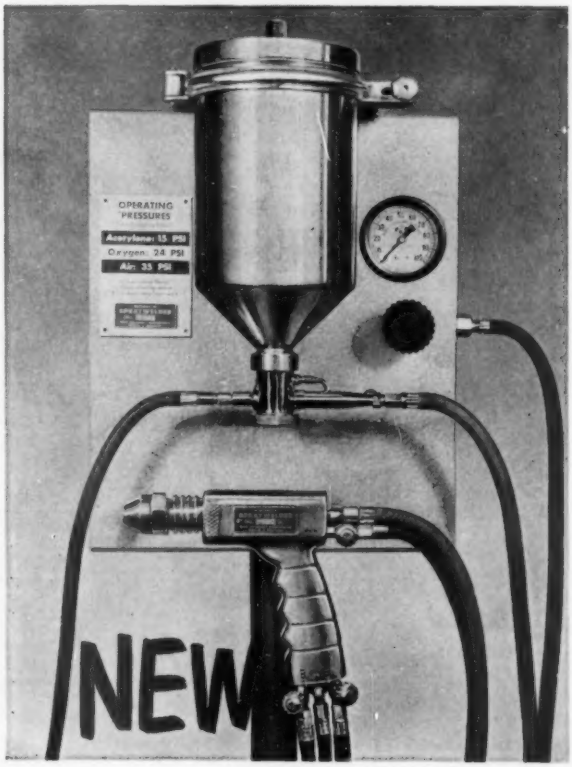
We've had some success with gaseous fluxes. Boron Trifluoride seems to be the best. We use it for brazing high beryllium copper base alloys. The big disadvantage of gaseous fluxes is their extreme activity. Boron trifluoride attacks the walls of the hot metal retort—and it's toxic. We have to use chemical traps and expell the gas from the pump oil.

USE THESE BRAZING ALLOYS

Many alloys can be used for vacuum brazing. In general we prefer nickel, silver, copper, and gold base alloys, and we often use pure silver for brazing titanium. Pure copper is generally used when the joint doesn't have to withstand high temperatures or corrosive environments.

We don't use brazing alloys with volatiles, like cadmium and zinc. An exception: you can make a sound joint with a nickel-phosphorous alloy even though most of the highly volatile phosphorous (about 10%) evaporates.

The nickel-base alloys, such as AMS 4775, 4777, and 4778 are excellent for vacuum brazing. These stainless-like alloys are strong at high temperatures. If you want good wetting as well as hot strength and oxidation resistance, use the gold-base alloys and those containing palladium. Tantalum is readily brazed with gold-nickel alloys. • •



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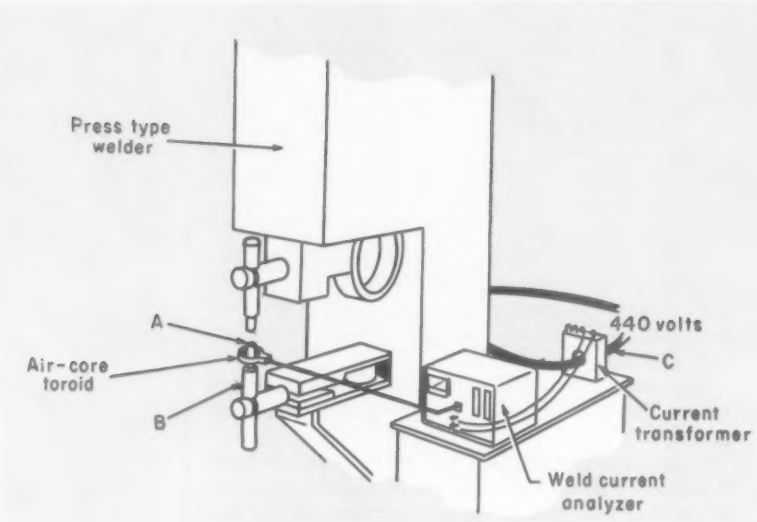


SKETCH of press-type welder shows the application of an air-core toroid, a current transformer and the weld current analyzer. The air-core toroid is placed over either the electode (A) or electode holder (B), in the welding secondary. The current transformer measures the welder primary by being placed over the primary current bus (C).

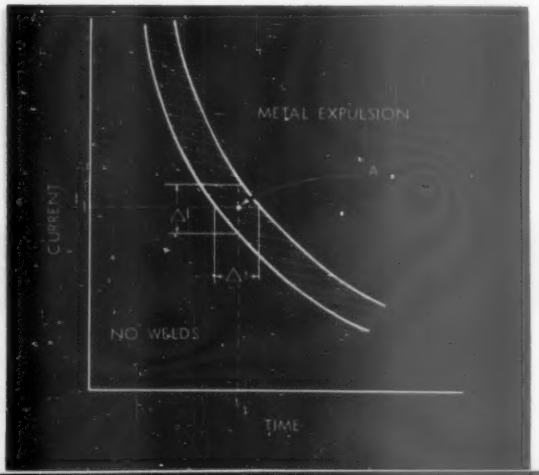
General Motors Corp. is getting better and more uniform spot welds as its new . . .

Current Analyzer Reduces

by **MILLARD A. FERGUSON,** *process development staff, General Motors Corp.*

IN BRIEF: A new current analyzer measures weld current and time and makes it easy to apply the resistance welding schedules which make possible high quality welds.

EVERYBODY AGREES that resistance welding schedules are a good thing. And now, our GMC Process Development Staff has come along with a new meter that makes it easier to set up these welding schedules. Its ease and speed will enable many of our plants that shunned schedules to now use them.

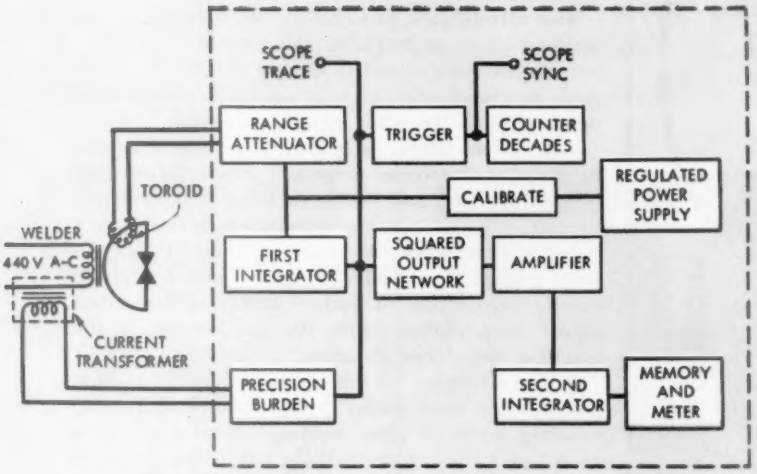


FOR A GIVEN WELD and a particular metal there is an optimum combination of current and time at which the best weld is produced. This graph shows the comparison of welding current and time for a hypothetical welding application. The hatched area is the welding zone, or the zone in which welding occurs. The optimum welding point for the given metal is A.

WELDING SCHEDULES

The American Welding Society and other groups developed these welding schedules. They list the best weld current, weld time, electrode, force and electrode tip shape for various combinations of metals and thicknesses. The schedules also help to reduce welding machine set-up time by telling the set-up man how to make a weld.

But plants don't use welding schedules as much as they should—and for good reason. It takes complicated instruments. Further, not every plant has the technically trained men to run the many pieces of equipment needed to measure weld current, time, and electrode force. Other plants may not have the equipment. Still other plants may have the men and the equipment but begrudge the lengthy job of setting up machines to conform to a welding schedule.



BLOCK DIAGRAM illustrates internal functioning of weld current analyzer. It shows the application of the meter on a 440-volt AC welding machine. Both kinds of pickups (toroidal and current transformer) are illustrated, although only one is used in any given application. The pickup delivers input to the meter (enclosed by dotted lines) through one of the input receptacles, depending upon the kind of pickup used. After modification by the meter circuitry, the information is produced as output at any one of the three points shown. The output is delivered for scope trace or memory and meter through the current jack of the meter.

Spot Welding Set Up Time

METER DEVELOPMENT

The new instrument is called the weld current analyzer. It can use any one of three pickups—an air-core toroid, a fork-type toroid, and the secondary of a convential current transformer. The toroidal pickups measure welder secondary currents directly. Heavy binding posts accommodate the secondary of a current transformer, measure welder primary currents.

The air-core toroid pickup is potted in an epoxy resin for ruggedness. It comes in various sizes, slips over the electrode or electrode holder in the welder secondary (see sketch).

The fork, or parallel toroid pickup, is new. A. W. Kolb developed it at our Delco Products Division. It works on the same principle as an ordinary toroid, can be considered as a deformed toroid with sections removed. The removed sections contribute little to the output voltage. The fork may be used at various places in the welder secondary circuit. The pickup gives excellent results if the cross section current carrying member is not greater than 2.0- by 10 inches.

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The two toroidal pickups enable the meter to be used with most resistance welding machines. For those welders where the two toroids will not work, the third pickup, a conventional current transformer, is used to feed the meter. The meter then behaves like a 5-amp ammeter with a memory. The meter retains the reading long enough for easy reading.

OPERATE AND READ

A 6-position selector matches the meter to the magnitude of the current to be measured.

- You use the 5-amp position when a current transformer is furnishing the input signal.
- You use the toroidal type pickups marked K-amp (kilo-amperes) in one of four positions. This switching arrangement gives you four overlapping ranges (full scale) of 5-, 10-, 20-, and 40 kilo-amps.
- You use the sixth switch position, marked *cal* to check the operation of the meter.

Two electronic counters give the weld time in cycles, up to a limit of 99. Pushing reset button clears the counters and zeros the meter. To zero the meter exactly you use a meter control.

To view the waveforms being measured, you use

continued on page 58

"Yes, the De Witt System of Joint Preparation is Worth Investigating"

said 13 prominent pipe manufacturers and welding experts who saw it demonstrated

More than 20 years of preparation were required to develop the De Witt System of Joint Preparation. Revolutionary in concept and application, it prepares joints in ANY metal with a minimum of work and expense.

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CURRENT ANALYZER

continued from page 57

the current jack and the *sync* jack.

The current jack provides an output signal to an oscilloscope or an amplifier and recorder. A connector marked *sync* is used to exactly trigger an oscilloscope in special cases, such as when you want to view or photograph the trace of a 1-cycle weld.

The current output jack furnishes a signal similar in shape to the welder secondary, when the toroidal pickups are used, and similar in shape to the primary current, when a current transformer is used as a signal source. When the range switch is in the calibrate position, a regulated 60-cycle signal is supplied to the current output jack, forming a convenient means of adjusting either the oscilloscope or the amplifier recorder combination.

A visual display of the welder secondary current waveform is most useful in the set-up and trouble shooting work of plant welding departments. If a record of a trace is desired, the technicians may use either the oscilloscope camera or an amplifier-recorder. Phase-shifted waves are not revealed in sufficient detail by the recorders generally found in a manufacturing plant. Usually the oscilloscope serves better for this purpose.

To obtain a signal to operate the electronic counters, a shaping circuit shapes the output of the first integrator into a square wave. The first, or *ones*, counter registers one count for every square wave received, and passes a signal to drive the second, or *tens*, counters for every 10 pulses received. The machine counts weld times of phase-shifted and sinusoidal currents with absolute accuracy.

You use the output of the sync jack when you want to display on an oscilloscope the waveform of the current under consideration. This output has been found valuable when 1- or 2-cycle phase-shifted weld currents are being studied. The synchronizing signal from the weld current itself is used to produce consistent, easily photographed, oscilloscope representations.

EDITOR'S NOTE: Several companies make a similar current analyzer. These include Brush Instruments Division of Clevite Corp., Cleveland, Ohio; Control Devices, Inc., Birmingham, Michigan; Hirst Electronics Ltd., Sussex, England; Instrument Control Co., Minneapolis, Minnesota; Sciaky Bros., Inc., Chicago; and Waterman Products Co., Inc., Philadelphia. • •

NEW DEVELOPMENTS FOR RESISTANCE WELDING

is the theme of our 3rd annual resistance welding issue which we will publish next month. One complete section of that issue will be devoted to application-type articles showing how industry is using the latest resistance welding equipment and processes. Another section will feature the newest resistance welding products.

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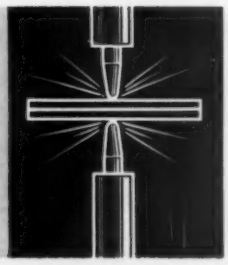
MALLORY MEMOS

NEWS AND TIPS ON RESISTANCE WELDING

P. R. Mallory & Co. Inc., Indianapolis 6, Indiana

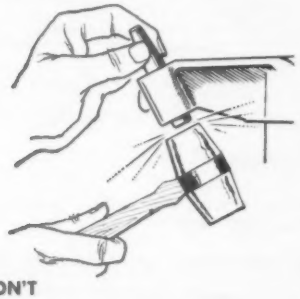


WELDING HINTS

Do's and Don'ts of Resistance Welding

DO

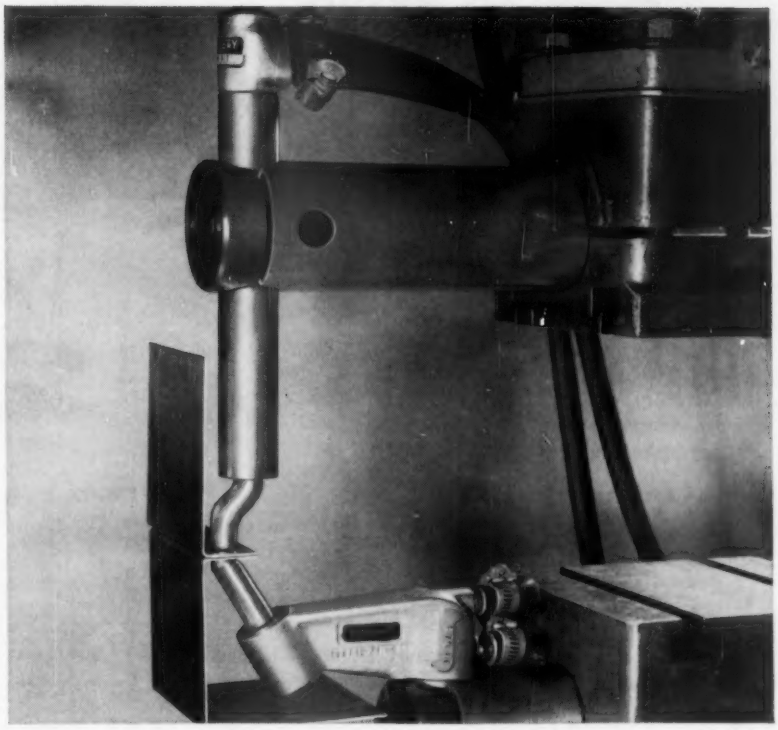
Use the most suitable tip diameter for the thickness of stock being welded. Too small a tip may cause excessive indentation, and too large a tip won't give enough concentration of heat. There is a Mallory electrode to suit every welding need.



DON'T

Don't allow the electrodes to remain idle in tapered holder seats for extended periods. They may bind and become difficult to remove.

Send for this useful chart of 34 Do's and Don'ts for Resistance Welding. Hang it on the wall in your shop for handy reference.



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Welding in tight corners or inside joints and other difficult places can be handled by standard Mallory bent electrodes. You can forget about custom-designs and extra costs for tricky set-ups. The Mallory standard line contains 51 different special shaped electrodes —single bend, double bend and offset. What's more, many Mallory electrodes contain cooling water tubes that are bent in place*...and cool right up to the electrode tip.

Your Mallory distributor stocks a wide variety of special electrodes plus 113 different straight electrodes with various tip designs. There is a Mallory developed alloy to fit every combination of metals and welding conditions.

Mallory welding products are available from authorized distributors located in all principal cities.

*Patent No. 2,489,993

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This metal is strong at elevated temperatures and has high elasticity. So, it's being used more and more in jet-age applications. That's why you should know . . .

How To Weld Molybdenum

IN BRIEF: This is the first of a series of three articles on fusion welding molybdenum. Arc and resistance welding will be discussed in succeeding issues.

MOLYBDENUM is very strong at elevated temperatures (over 1,800°F) and it has high modulus of elasticity. Unlike most of the nonrefractory high-temperature materials, molybdenum has a high thermal conductivity. For some uses this is valuable, but it may make welding difficult.

OTHER PROPERTIES

Molybdenum's inability to resist oxidation at elevated temperatures is not of much consequence in welding. Either the weld area is shielded or the weld is made so rapidly that there is not time for severe oxiation.

Molybdenum is also brittle. Steel is too, at some temperatures, but molybdenum's brittleness causes much more trouble. It's fair to say that success in all welding of molybdenum is to avoid brittleness or, saying the same thing another way, to retain ductility.

PURE OR ALLOYED

Today, you can get pure or alloyed molybdenum. The pure is made by powder metallurgy or by arc casting. The powder metal product must be handled differently in welding from the arc cast. Most of this article deals with the arc-cast metal.

Arc-cast molybdenum is made by vacuum melting, with carbon added during melting. The carbon in the analysis of commercial arc-cast molybdenum in Figure 1 may be high for current production lots. This is important and will be discussed later. The important point is that the arc-cast metal contains very little oxygen. The powder-metallurgy metal contains considerably more.

COMMONEST ALLOY CONTAINS ½ PERCENT TITANIUM

The commonest alloy is one containing ½ percent titanium. Most of what will be said about welding carbon-deoxidized arc-cast molybdenum will apply to the ½ percent titanium alloy. One thing to re-

continued on page 62

FACTS ON WELDING MOLYBDENUM

	Composition, weight per cent		
	C	O_2	N_2
Commercial wrought			
Commercial cast	0.044	0.0006	0.0005
(PM)*	0.003	0.0046	0.0005
High purity	0.002	0.0002	0.0002

* PM = Powder Metallurgy

FIGURE 1: Composition of typical molybdenum alloys.

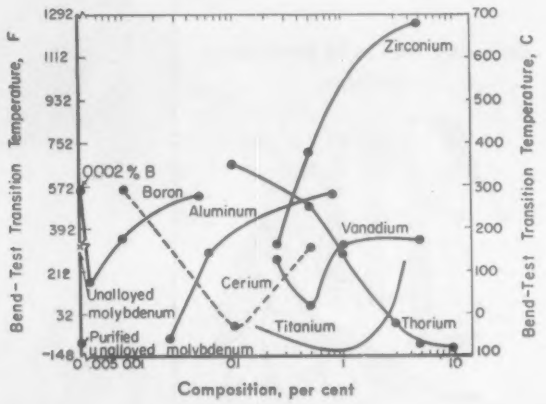

FIGURE 2: Effect of various elements on bend-test transition temperature of cast molybdenum.

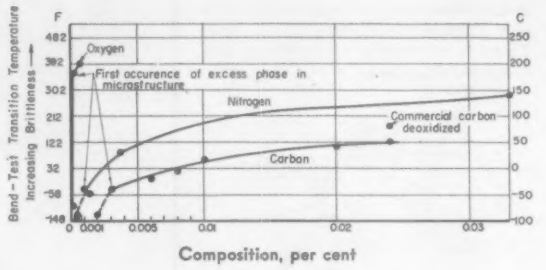

FIGURE 3: Effect of oxygen, nitrogen and carbon upon bend-test transition temperature of cast molybdenum.

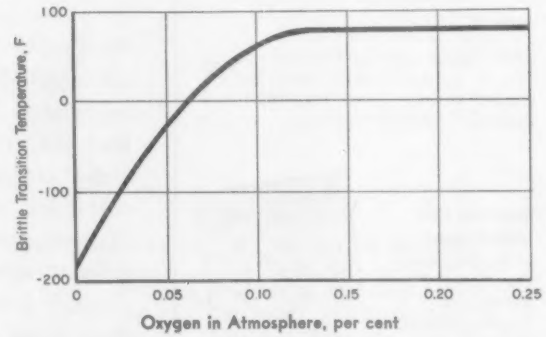

FIGURE 4: Effect of oxygen in welding atmosphere on brittle transition temperature of molybdenum welds.

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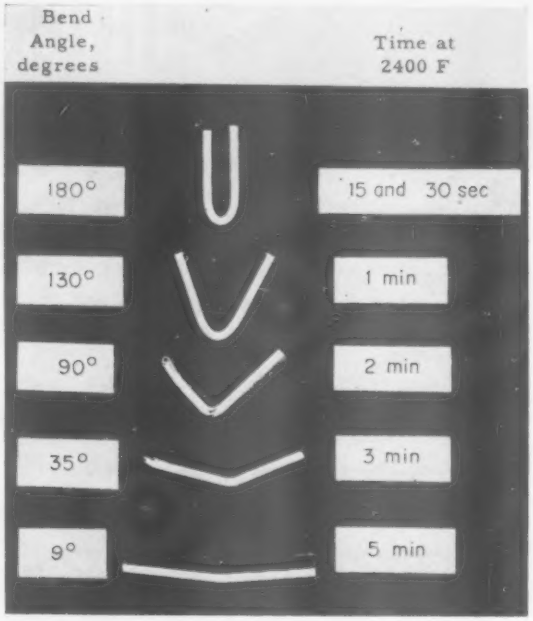
member about molybdenum alloys is that the welds will not have the high strengths which are obtained as a result of high recrystallization temperatures and cold work. At best, high recrystallization temperatures will make the heat-affected zones narrower.

WHY MOLYBDENUM IS HARD TO WELD

The volatility of molybdenum oxide at high temperatures is not a problem in welding, but brittleness is. Recrystallization and grain growth make molybdenum brittle and so does contamination or alloying by certain elements. Molybdenum in the cold-worked condition is reasonably ductile. Recrystallized, it may become brittle. After being cold worked, molybdenum can be recrystallized by heating above a critical temperature and holding for a given time. As the time and temperature are increased the specimens will break easier. Microstructure examination of these specimens would show recrystallization. It would also show that the specimens heated longest had the largest grains.



HOLDING commercial unalloyed wrought molybdenum at 2400°F for varying lengths of time show marked effect on bend ductility. As time increases (right), the amount the specimen can be bent before it breaks, decreases (left).

BRITTLE TRANSITION TEMPERATURE

Figure 2 shows how alloys affect the brittle transition temperature of molybdenum. All of the elements shown on this figure can be considered deoxidizers for molybdenum. This is important and will be discussed in Part II. Notice how most of the elements do two things. In small amounts, they tend to lower the bend-test transition temperature. Over a critical amount they make the bend-test temperature start

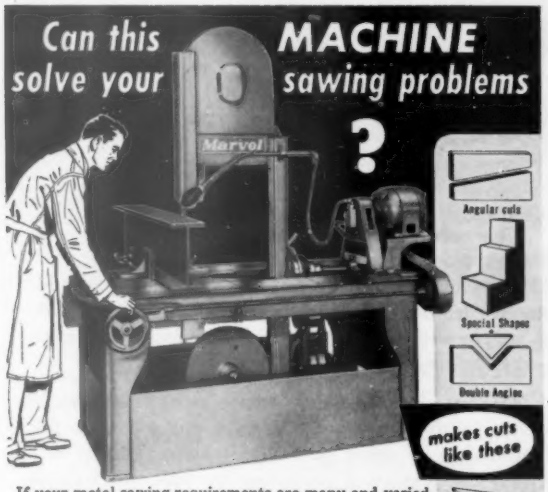
up again. The reason is shown in Figure 3. Carbon, nitrogen, and oxygen in any amounts tend to lower the bend-test transition temperature, but oxygen has much the greatest effect. That is why the deoxidizing elements shown in Figure 2 lowered the bend-test transition temperature. They do it by removing oxygen. Carbon does the same thing. Even though it raises the bend-test transition temperature, it removes oxygen, which has a much greater opposite effect.

It is the effect of oxygen on ductility that is the major concern in welding molybdenum. Cold-worked molybdenum has a fibrous microstructure and its oxygen content can be reasonably high without serious effect on ductility. Recrystallized molybdenum or cast molybdenum, however, must have a very low oxygen content or the ductility will be very poor below 400° to 500°F.

Grain size and contaminants also affect bend ductility.

Some of the difference between the brittle transition temperature for wrought materials and the welds in that wrought material also may be caused by oxygen pickup during welding (Figure 4). Actually, welding is one continuous struggle to prevent contamination of the weld metal by oxygen. • •

EDITOR'S NOTE: This material is based on a paper presented by D. C. Martin of Battelle Memorial Institute at a recent ASM Woodside Panel Conference.



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the preparation

the welding

BAND SAW MACHINE (above) cuts off lengths of pipe and tubing with edges that are within a few thousandths of being perfectly straight—well within the permissible tolerances required by jigs and fixtures used in automatic submerged arc welding of heat exchanger bodies and inlet connections. End bell is welded to heat exchanger unit (left).

Straight Cut Edges On Pipe And Tubing Increase Welding Speed And Quality

IN BRIEF: Blade-steering control on band saw machine keeps blade cutting accurately, increases blade life as much as 50 percent.

WELDING COSTS WERE CUT, production simplified, and several machining operations avoided when Bell & Gossett Company bought new cutoff equipment. They're at Morton Grove, Illinois, and make heat exchangers and heat transfer units.

The problem: Bell & Gossett's supervisors knew their cutoff equipment was adequate for most jobs. However, it could not cut the ends of pipe and tubing straight enough on special heat exchanger bodies and inlet connections. This meant pipe and tube ends had to be machined before they could be welded into an assembly. Straight ends are important in the automatic submerged arc welding done by the firm. Straight ends are needed to make full penetration welds which will pass X-ray inspection.

The solution: The company bought a highspeed Marvel No. 81 bandsaw made by Armstrong-Blum Manufacturing Co. This machine has a unique blade steering feature called the "Sure-Line" blade-controller. A simple electromechanical servomechanism, it automatically keeps the saw blade on the exact line of cut.

The results: The new saw cuts stock from 2 to 18 inches in diameter, and the cuts are within a few thousandths of being perfectly straight. This is well within the tolerances permitted by jigs and fixtures used in automatic submerged arc welding.

The saw cuts fast enough to keep production moving and still maintain a 50 per cent reserve supply.

The bandsaw is designed to cut with highspeed-steel blades. In the long run, these are 35 percent cheaper than carbon steel blades. The blade-steering device—through keeping blades cutting accurately—increases blade life as much as 50 percent.

The saw will make angular cuts and minor cuts without moving the work. The saw's upright column may be tilted 45° to right or left of vertical. • •

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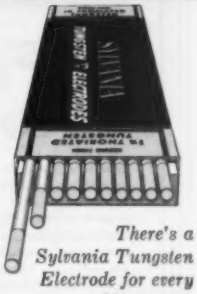

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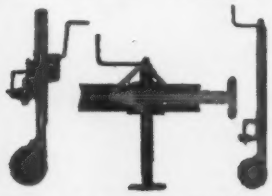
BULL DOG JACKS



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Complete Spindle End Assemblies for 2,500, 4,000 and 5,000 lb. capacities Per Pair. Available in complete assemblies or individual parts — Spindle Ends, Hubs, Wheels.

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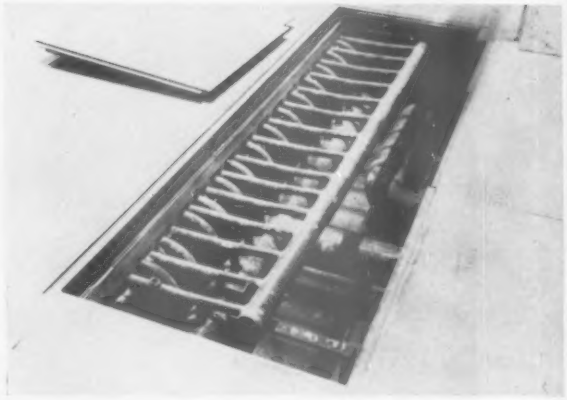


WELDED STEEL PIPE is an integral part of this 85- by 200-foot ice skating rink floor. Cross trench (right) show arrangement of supply and return headers.

10½ miles of welded steel piping help make ice for skating rink

IN BRIEF: An engineering firm was able to check an ice skating rink's welded steel piping system after one season's use. Welds were sound and there was no corrosion.

WHEN YOU BUILD an ice skating rink, the custom is to hydrostatically test the miles of welded coils just before you embed them forever in concrete. Engineers seldom have an opportunity to see what happens to the welded pipe after a season's use, unless some misfortune calls for chipping them out.

The Jarvis Engineering Co., South Boston, had the chance. They built the rink in the Central Maine Youth Center at Lewiston. The Order of Dominican Fathers, helped by contributions, sponsored the center. Except for the pouring of the concrete, Jarvis finished the rink just at the opening of the skating season. The Fathers wanted to open the rink for the season, if at all possible. Jarvis thought it was. They tested the coils, covered them with sand instead of concrete, flooded the rink, and opened it to the youth of the vicinity.

Into the rink went over 10½ miles of 1¼-inch standard steel pipe made by the Jones & Laughlin Steel Corp. Jarvis welded the pipe joints into hairpin pattern coils. First they put down a concrete foundation. On it they set metal chairs to raise the pipes off the slab. To the chairs they wired the pipes on 4-inch centers. They planned to pour a 5-inch thick

finish slab of concrete over all to completely incase the pipes.

Rust-inhibiting calcium chloride solution circulates through the pipes. It's cooled by two 75- h.p. direct-connected, freon compressors. It's circulated by two h.p. pumps, each rated at 650 gpm. The supply and return headers are also made of pipe and are graduated from three to eight inch pipe. The supply and return header assembly is also welded together.

At the end of the season in April, Jarvis shut down the rink and took up the sand. They inspected the pipe, found no leaks or defects. The welds were sound. There was no evidence of rust. The flow of the calcium chloride solution was well balanced.

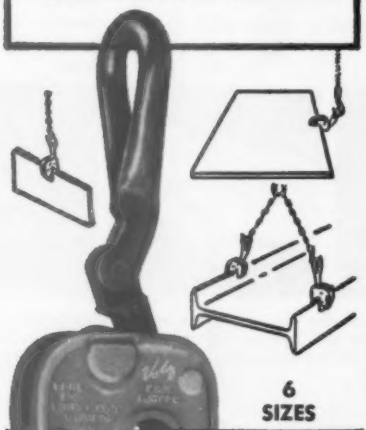
Piping was then embedded permanently in concrete.

The entire project was designed and engineered by C. H. Mitchell, chief mechanical engineer of Alonzo J. Harriman, Inc., Auburn, Me., architectural and engineering firm.

The rink is designed to seat 3000. It is equipped with one of the largest portable wooden floors in the country. • •

YOUR BEST MOVE . . . MOVE with **MERRILL** MATERIAL HANDLING DEVICES FOR THE MOST IN *Safety and Economy*

Imitated, but never duplicated, Merrill Lifting Clamps are Drop Forged to give you Safety in Handling and Economy in Operation.



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HORIZONTAL PLATE CLAMP
Rated capacity — 3 ton (6 tons per pair). Completely drop forged . . . Heat treated.

Over 25 Material Handling Devices described in our catalog C-2.

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PLASTIC WELDING

VALUABLE NEW DATA

During the last few years gas welding of plastics has been applied with particular success to a large and ever-increasing variety of constructions where it has proved invaluable. Information on this subject is rather scarce. This manual will be extremely valuable to practical welding people and to engineers who intend to incorporate plastic materials into their designs.

PRICE $6.00

WELDING DESIGN & FABRICATION
812 HURON ROAD
CLEVELAND 15, OHIO

no matter what the two metals are . . .
now you can **SOLDER** them

PROBLEM:
Joining copper pipes in extremely hard water area. Lead solders made porous joints. Heat required for high temperature solders burned copper pipes.

SOLUTION:
All-State's #430, a silver-bearing solder which flows at 430F, made perfect, permanent joints, solved the problem.

ALL-STATE has a solder for joining any commercial metal or alloy to any other . . . in one or more temperature ranges. For typical examples, see tables below:

400°F-500°F

Al.	Copper	Brass	Steel	S.S.	Nickel
37	107	107	107	107	107
107	430	430	430	430	430
107	430	430	430	430	430
107	430	430	430	430	430
107	430	430	430	430	430
107	430	430	430	430	430

700°F-800°F

	Al.	Copper	Brass	Steel	S.S.	Nickel
Aluminum	56	105	105	105	105	105
Copper	105	105	105	105	105	105
Brass	105	105	105	105	105	105
Steel	105	105	105	105	105	105
Stain. Steel	105	105	105	105	105	105
Nickel	105	105	105	105	105	105

Reference numbers above indicate All-State solder to be used for joining metals.

A set of four complete tables, covering temperature ranges from 400F to 800F, is yours for the asking. Send for free Instruction Manual, too.

All-State
Distributor Stocked, convenient to buy. Economical to use.
ALL-STATE WELDING ALLOYS CO., INC., White Plains, N. Y.
Call WHite Plains 8-4646 or write for nearest distributor

For More Information Circle No. 4 on Reader Service Card.

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*temperature indicating crayons**

**Also Tempil° Pellets and Tempilaq° (liquid form)*

Tempilstik°—a simple and accurate means of determining preheating and stress relieving temperatures in welding operations. Widely used in all heat treating—as well as in hundreds of other heat-dependent processes in industry. Available in 80 different temperature ratings from 113°F to 2500°F . . . $2.00 each.

Send for free sample Tempil° Pellets. State temperature desired . . . Sorry, no sample Tempilstiks°

Most industrial and welding supply houses carry Tempilstiks° . . . if yours does not, write for information to:

SALES DEPARTMENT

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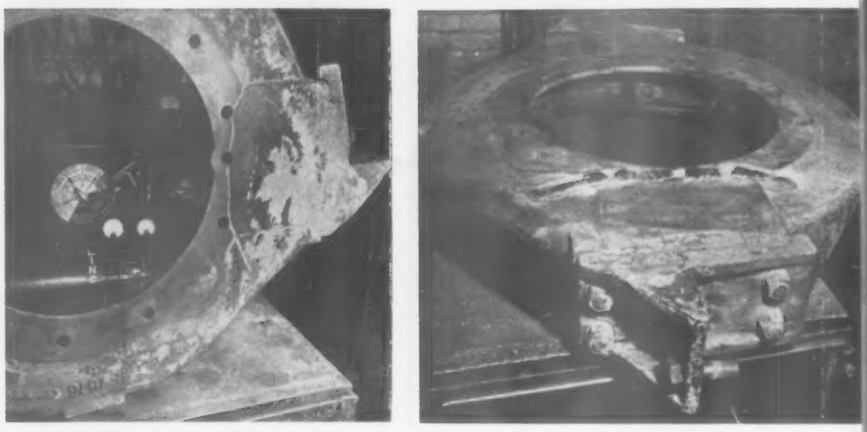
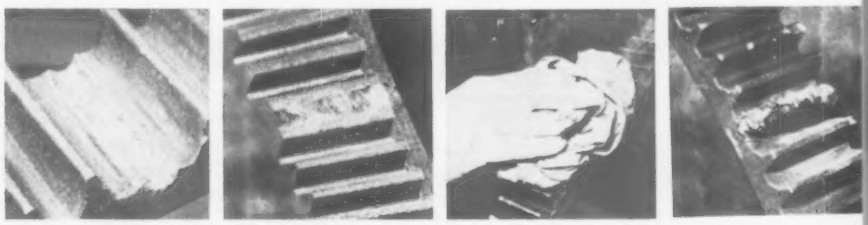
NEW PRODUCTS



CRACKED FLYWHEEL HOUSING for huge piece of construction equipment had to be repaired in a hurry to keep costly downtime to a minimum. Job was completed and ready for grinding in a matter of minutes.



CAST IRON GEAR TOOTH is removed by chamfering electrode, leaving anti-stress groove (1). Groove is filled and entire weld area tinned with special sealing electrode (2). Each pass made with new electrode is quenched with wet rag immediately after arc is broken (3) until completed job (4) is ready for machining.

3 steps to faster cast iron arc welding

This simple process is said to cut 90% off the time it takes to arc weld cast iron by conventional methods. Eutectic Welding Alloys Corp. explains that its new *QuenchWeld* process is based on a new electrode whose deposits can be quenched without cracking. This eliminates slow cooling between passes. Preheating is not needed; nor is peening in most cases. The toxic fumes some cast iron welding processes generate are also said to be eliminated.

The process is suitable for thin sections and heavy castings. It can be used to repair cracked or broken castings, to fill blowholes and machining errors, to build up worn and broken or damaged surfaces. With this process cast iron parts can be welded together, and cast iron can be welded to steel.

Even large castings, such as machine tool and press bases, columns and pedestals, can be repaired permanently, rapidly, and right in place.

There are three steps, all aimed at the three main reasons why welds in cast iron sometimes crack.

First, with a chamfering electrode vee out the area to be welded and make grooves to break up stress concentrations around the vee.

Second, fill the anti-stress grooves and in the entire weld area with a thin deposit. A special electrode seals the surface so grease, chemicals and other contaminants cannot affect the soundness of the weld metal.

The third step is to complete the weld with a special new electrode. In the past, sound deposits could be made if each pass was allowed to cool slowly before another was made. Now, Eutectic explains, its new *QuenchTrode 24* electrode provides a low carbon deposit, that is alloyed with grain-refining elements. This deposit is machineable, tough enough to cool fast without cracking. It is an all-position AC or DC edectrode, come in 3⁄32, 1⁄8, 5⁄32 and 3⁄16 inch diameters.

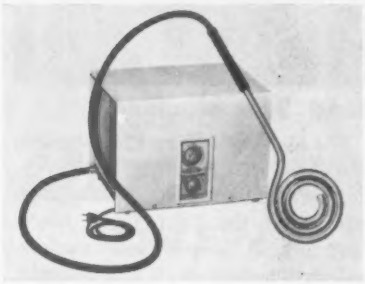
The job is completed by making back-step welds with one- to four-inch beads, depending on section thickness. Each pass is quenched as soon as the arc is broken. The next pass is made immediately. Quenching is ordinarily done with water and peening is not required. Air blasts are sometimes used or quenching. When they are, peening is recommended, but is not essential.

Between the quenching and no preheating, the base metal's temperature is not raised as much as if conven-

tional welding methods were used. The new process can make repairs that used to be avoided because excessive heat caused distortion and cracking. Eutectic estimates the 10 to 20 percent of damaged castings now being salvaged by welding can be raised to nearly 100 percent.

The *QuenchWeld* process can be used with almost any cast iron. Exceptions are chilled iron, Ni-Hard, and similar materials which themselves would crack during quenching of the weld metal.

Circle No. 217 on Reader Service Card.



On-The-Spot Cooling

This portable thermal unit was designed by Frigidheat Industries to cool spot welding electrodes and torch tips or wherever a small cooling device is needed in a remote, compact or work-free area.

The unit can also be used in processing radiographic or standard photographic films.

It offers refrigeration on the end of a stick with the re-cycle of the refrigerant causing a reversal of the wand temperature.

Circle No. 80 on Reader Service Card.

Moisture Stabilizer

A new, portable, welding electrode moisture stabilizer has been developed by W Corporation. The Hotbox is a sturdy, insulated steel container with thermostatically controlled electric heating elements. Electrodes kept in it will not be contaminated by moisture. This eliminates welding problems caused by excessive moisture in electrodes: surface- and underbead cracking, porosity, excessive spatter and added costs due to weld replacement.

It operates on either 115v AC or DC, holds 50 lbs. of electrodes, maintains temperatures at 215°F.

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HARD-N-TUFF **HARDENS**

TOOLS and PARTS

RIGHT IN YOUR OWN SHOP

You can get three times more wear from tools and parts by putting every fast-wearing edge and surface through a simple 3-step operation — without special equipment — right in your own shop.

HARD-N-TUFF Steel Hardening Compound:

- Puts a file-hard surface on any steel, cast iron or iron-base metal in minutes.
- Leaves metal core tough, resilient, avoiding breakage.
- Hardens only the critical cutting, bearing or impact area.
- Super-hard surface will not crack or scuff off.
- Does not affect critical shapes or dimensions.
- Safe, non-toxic.

HARD-N-TUFF nitrides, chromizes and carburizes in one easy operation. Simply heat part, apply HARD-N-TUFF and reheat, then quench. **That's all there is to it!**

Order Your Trial Supply NOW.
Get 3 oz. cans for only $2.00 or
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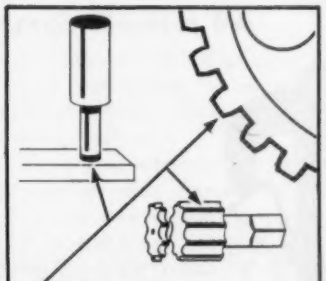

- Harden Critical areas only.
- Leave Tough Cores

Use HARD-N-TUFF on dies, jigs, fixtures, gears, bearings — any impact cutting or bearing surface.

IT'S THE SURFACE HARDNESS THAT COUNTS

Ask your Industrial Distributor or Write

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...variations in arc stability

M&T Murex AC
Industrial Arc Welder

Has patented dual-coil transformer with balanced electrical circuit • Promotes smooth, steady arc under all welding conditions • Glass insulated windings add to transformer life • Rigidly, permanently mounted chatter-free shunt • Single inch of shunt travel adjusts for entire output current range • Write for data sheet that tells you more.

M&T **welding products**

METAL & THERMIT CORPORATION
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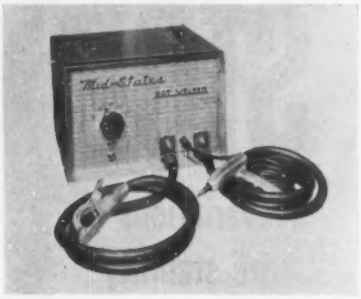

Dot Welding

Errors, scratches, cavities and undercuts in injection molding dies need no longer be a problem in the die casting industry. A new, fast and inexpensive method of repairing the dies has recently been developed by the Mid States Welder Manufacturing Company. The field-tested process is a realistic answer to the bothersome, time-consuming problem that has hampered the die casting industry for many years.

The new process is called "Dot Welding" and is described as a fusion of metal pellets by a gun-type welding device into the damaged die. The die need not be removed from the machine to make the repair. Fusion is produced by a short pulse of high density electrical current in the welder. This current raises the temperature to the point of fusion and allows the pellet to flow into the cavity or scratch—the heat does not harm the die metal.

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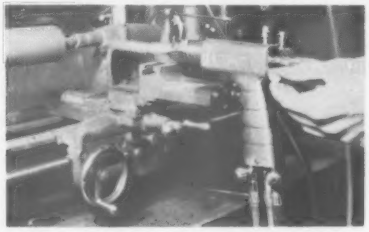

Spraywelder Surfacing

The Model D Spraywelder just introduced by Wall Colmonoy Corp. is said to hard surface at over 12 pounds per hour and is up to 95 percent efficient. Other features listed for the Spraywelder include lighter weight, simplified operation, new powder level indicator, larger capacity hopper (15 pounds), and new compact panel.

Unit uses compressed air which permits all-position use and produces porosity-free deposits.

Circle No. 74 on Reader Service Card.

Band Saw Machine

The highspeed Marvel No. 81 band saw made by Armstrong-Blum Mfg. Co. has a unique blade steering feature called the "Sure-Line" blade-controller. A simple electromechanical servomechanism, it automatically keeps the saw blade on the exact line of cut yielding square cut edges and extending blade life as much as 50 percent.

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A LEADER
for over 40 years . . .

SHAWINIGAN
TRADE MARK REGISTERED

Warehouse stocks in all important cities and towns.

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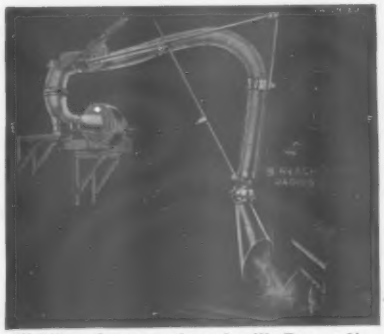
Remove Welding Fumes at the Source... with RUEMELIN FUME COLLECTOR



Welding shops equipped with Ruemelin Fume Collectors are assured of a clean shop atmosphere. Noxious fumes, heat and smoke are eliminated AT THEIR SOURCE. Improves working conditions . . . lessens fatigue . . . paves the way for increased plant production. Especially helpful in winter months when windows and doors are closed.

Note the new spring-loaded counterbalance mechanism which makes Fume Collectors much easier to handle.

WRITE FOR DETAILED INFORMATION

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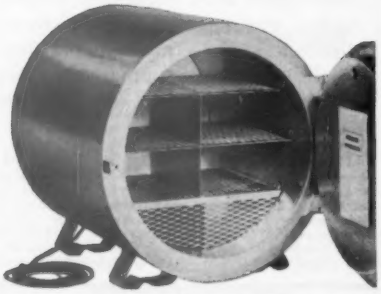
YOU CAN KEEP 'EM DRY

FOR 14c A DAY

Moisture-proof your electrodes at low cost with

DryRod® OVEN



Fourteen cents worth of electricity per day — that's about all it takes to operate the popular, Type 300 DryRod electrode oven. At that rate, and its low purchase price, you can't afford to be without DryRod protection against moist mineral coated rods. Insure your electrode investment against:

- POROSITY • UNDER-BEAD CRACKING
- ROUGH WELDS • ROD SCRAP LOSS
- REJECTS • REWORKS
- PRODUCTION SLOWDOWN

NEW! 800° or 1000° HIGH TEMPERATURE Re-baking Oven now available

The DryRod line of ovens now includes four basic models to meet every welding requirement.

Write for new folder "DryRod as Standard Welding Equipment".

PHOENIX PRODUCTS COMPANY
4731 N. 27th St. • Milwaukee 9, Wis.
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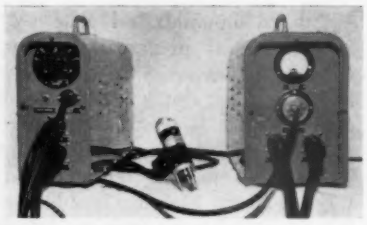

Stud Welder

A new compact, portable stud welder designed to weld studs to aluminum or steel without distortion or burn-through—even in sheet metal—has been announced by Omark Industries, Inc. Called Omark-Graham Twin Pack, unit operates on standard 115 volt, AC current. The 60 lb. unit requires no flux, ferrules, inert gas or special preparation, because of the stud tip design and the stored energy principle.

Circle No. 219 on Reader Service Card.

Preheat System

Building Block electrical strip heater system has been introduced by J. B. Nottingham & Co., Inc. to facilitate prevention of underbead cracking and other welding defects. Advantages: Continuous control of heat input; no cold spots; personnel and equipment protection; and fast, simple installation.

Weldments are preheated by 1- and 2-foot strip heat units with full-length heating elements and aluminum contact shoes; they can be ganged to suit job. Electrical system can feed up to 48 heaters.

Circle No. 220 on Reader Service Card.

Arcair Control Unit

The Model "A" Contactor is a special control unit for use with the automatic Arcair torch and also for welding equipment.

Its purpose is to interrupt high amperage secondary currents for safety of both personnel and equipment. It is a compact unit measuring 8½" wide, 10" in depth and 20" in height. The complete unit, ready to be wired into a circuit weights only a little more than 40 pounds.

Built to withstand rough use, it is equipped with extremely heavy silver alloy contacts. Though rated at 600 amps, this contactor has performed satisfactorily under much higher loads.

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LOOK

...at this "Jack of all welding jobs"

M&T Murex Muretran* All-Purpose Welder

Most versatile welder ever developed • Instant changeover to manual, automatic, inert-gas spot, MIG and TIG welding • Unique plug-in timers for gas pre-flow, post-flow, high frequency drop-out, spot arc • Patented, dual coil windings in saturable shunt transformer • Sealed silicon rectifiers assure highest efficiency, long life • AC-DC or AC models • Write for data sheet.

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M&T welding products

METAL & THERMIT CORPORATION
General Offices: Rahway, New Jersey
Circle No. 84 on Reader Service Card.

Hardsurfacing Electrode

Tufanhard 375, made by Hobart Bros. Co., is an extruded heavily coated electrode for good wear resistance under medium impact. The weld is non-machineable but can be hot forged. The electrode has a stable coating containing iron powder for fast deposition. Weld hardness runs around Rockwell C 40.

Circle No. 200 on Reader Service Card.

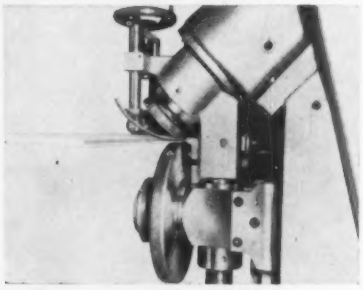
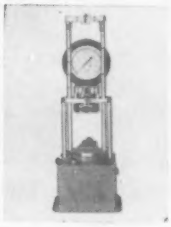


Plate Beveller

A development of American Pullmax Co., Inc. is the new Model X-8 Beveller. The compact X-8 cuts a ½" bevel on mild steel plate (⅜" in stainless) to prepare it for seam welding. It has saved up to 85% in bevelling time. Both sides of 1-inch plate can be bevelled. Small parts can be easily handled; large parts too with a support table. Cutting speed is about 11 fpm on mild steel X-8 is available in three models to cut 30, 37 ½-, and 45-degree bevels.

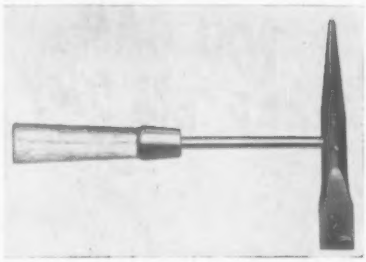
Circle No. 201 on Reader Service Card.

Low Load Testing



Interchangeable load cells are a feature of the model LPT testing machine announced by Detroit Testing Machine Co. Designed to perform tensile and compression tests at low loads, unit has 100-through 1,000 lb. load cells with gauges to match. Machine provides fast, smooth operation and has two controls: one for ram movement, the other for ram speed.

Circle No. 202 on Reader Service Card.



Cleaning Tool Improved

A recent design improvement has been made to the Atlas Tomahawk by Atlas Welding Accessories, Inc., the manufacturer. The head, which is press fitted on the shaft, is now further secured by a steel pin. This means that the head can't loosen, twist, or fly off the shaft.

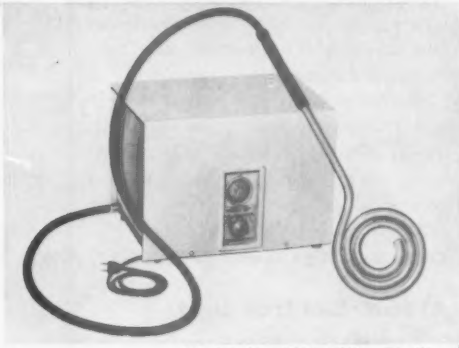
Circle No. 203 on Reader Service Card.

Brazing Alloy

A new high-temperature controlled atmosphere alloy containing copper, nickel, and boron has been patented by Superweld Corp. The alloy, particularly useful in progressive step brazing techniques, is stronger than standard copper brazing alloys.

Circle No. 204 on Reader Service Card.

NOW... this new Portable Thermal Unit can be used for . . .



U.S. Pat. No. 2910838 Others Pending

On-The-Spot Cooling of Spot Welding Electrodes; Torch Tips; Processing X-Ray and Photo Films

The Portable Thermal Unit offers refrigeration and heating on the end of a stick with re-cycle of the refrigerant causing a reversal of the wand temperature. It may be used whenever a small cooling or heating device is needed in a remote, compact or work-free area. As pictured, it may be used to control solution temperatures in processing x-ray and photo film. It can be built to customer's specifications for other uses.

- No Plumbing Needed
- No Water Required
- Cool Or Heat
- Shockproof
- Fast Acting
- Wt. 54-½ Lbs.

MANUFACTURED BY: **FRIGIDHEAT INDUSTRIES**
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For More Information Circle No. 80 on Reader Service Card.

IN 1936, MORT CLARK, then Vice-President of the world's largest sign manufacturer, wanted a welded galvanized sign frame. Every welder manufacturer said it couldn't be done . . . Mort Clark did it, received a check and certificate of achievement from the Lincoln Welding Foundation—and

MORT CLARK'S **GALV-WELD** ALLOY ORIGINAL & GENUINE

WAS BORN

The Navy didn't believe, tested it 3384 hours in salt spray (100 hours is normal), then approved it. Westinghouse reports Galv-Weld roof sign, installed 1936—still perfect in 1959—23 YEARS LATER!

TIME PROVEN — MODESTLY PRICED
WHY EXPERIMENT?

Regalvanizes corrosive seams and areas where galvanizing is burned away by welding, skipped in hot dip galvanizing, or abraded in fabrication.

Eliminates corrosion areas produced by welding, so that weld will stand up under paint, WITHOUT rust, as on ornamental iron. Simply use residual heat from welding, or reheat, wire brush, and apply. No fluxing—No fumes.

Makes every welder a galvanizer of small weldments or parts. Repairs chipped porcelain, rusted appliances, rusted auto, truck or trailer bodies, frames, fenders, or other steel products. Can be readily refinished to match surrounding surface.

Ideal for pipe joints, galvanized structures, water and fuel tanks, duct systems, cold storage lockers, sinks, drains, washers, towers, steel buildings, railings, etc.

Some distributor franchises still available. Cash in on consistent campaign now running in 18 national magazines.

Mail Coupon Today

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Dept. WDF — Box 1303 — Bradenton, Fla.
Send Information User ☐ Distributor ☐
Dealer ☐ Free Sample ☐
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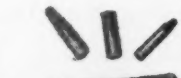
Circle No. 22 on Reader Service Card.

WELD WITH

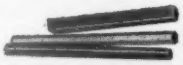
Tipaloy

YOUR Resistance Welding Electrode NEEDS Are OUR Business!

Whether it be:
TIPS:



ROD or BAR:

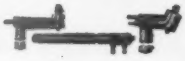


SEAM WELDING WHEELS:

FORGINGS:

CASTINGS:

HOLDERS:



ADAPTERS:

SPECIAL WELDING DIES or FIXTURES: TIPALOY *has them.*

BUY TIPALOY and save money!

TIPALOY can supply you with:
RWMA Class #1, Tipaloy #100
RWMA Class #2, Tipaloy #130*
RWMA Class #3, Tipaloy #200
and other RWMA classes of alloys to fit your needs.

It is unwise to pay too much, but it is worse to pay too little!

Use TIPALOY and get 30% to 100% more performance for your money than you are now getting.

BUY TIPALOY and get TIPALOY QUALITY

Send your trial order today

*TIPALOY #130 cast and processed under our patents.

FREE: Write for your copy of Tipaloy's comprehensive new catalog.

Distributors and Representatives: Write for complete information about available territories.

Tipaloy INC. 1423 E. MILWAUKEE AVE. DETROIT 11, MICHIGAN

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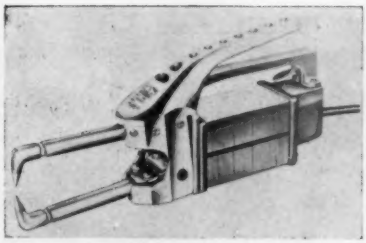


Portable Spot Welders

Two new portable spot welders, for mild steel, stainless steel, and galvanized iron up to ⅛-inch combined thickness in sheet or wire have been announced by Metal & Thermit Corp.

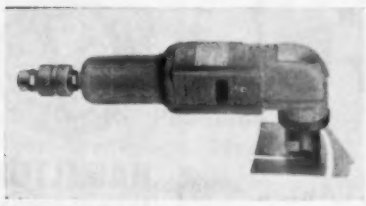
The rugged units weigh 24 lb. Model 11 operates from 115 volts AC and requires 3.3 KVA. Model 23 requires 230-volt AC and is rated at 4.4 KVA. A fixed tip tong rests full unit weight on the weld spot to free one hand, reduce fatigue, and add contact pressure.

Circle No. 205 on Reader Service Card.

Shelter, Divider Screens

Newly designed Porto-Screen Series 60 has been announced by Frommelt Industries. When assembled screens (tubular steel frames and U.L. approved fabric curtains) make the new shelter or storage Handi-Hut (6′ x 6′ x 7′) or become wind screens, welding shields, or room dividers. Eight screens can be whisked into a Handi-Hut in minutes; standard clamp hinges permit panels to be hinged for doors.

Circle No. 206 on Reader Service Card.



Pneumatic Nibbler

A new compact nibbler introduced by Modern Manufacturing Co., Inc. is capable of cutting sheet metal up to 13 gage stainless steel without distorting or curling.

The lightweight tool is designed for safe and efficient cutting of the heavier metal, something other nibblers of the same size and weight can't do.

Circle No. 207 on Reader Service Card.

LISTEN

. . . to this: silicon diodes deliver DC most efficiently

M&T Murex DC Rectifier Welder

Offers best type of rectifier for this service: non-aging silicon diodes—hermetically sealed • Assure long life, extremely dependable operation, as much as 98% efficiency • Machine designed for instant recovery voltage: arc easily struck, stabilized, maintained • Easy settings: simple selector and knob control for current range, polarity • Write for data sheet.

M&T welding products

METAL & THERMIT CORPORATION
General Offices: Rahway, New Jersey

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Circle No. 16 on Reader Service Card.

DO YOU HAVE UNSOLVED TESTING PROBLEMS ????

They can be solved. We design and build special testing machines to fit the most peculiar requirements.

Tell us about yours.

DETROIT TESTING MACHINE COMPANY
9396 Grinnell Avenue, Detroit 13, Michigan

Moderate-production-rate bending machines

The new S-M line of bending machines was developed by Wallace Supplies Mfg. Co. for pipe, tube, angles, channels, and other structural shapes in any bendable metal. The machines are also used on rolled or extruded special shapes. (S-M stands for Section Modulus and the number that accompanies S-M is a direct technical size identification).

The benders are available in four sizes for handling work from .6 SM (approximately 2-inch standard pipe) to 18.0 S-M (approximately 8-inch standard pipe).

The unit is described as a low first-cost moderate-production-rate bender. It has hydraulic power—90° plus springback on one setting. 180° plus springback on a second setting. This is practical for most shops because about 85 percent of all bends are made 90° or less.

Benders are available with or without mandrel units.

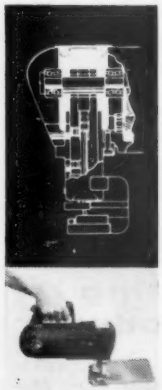
Clamping and power pressure die movement are also available.

Circle No. 213 on Reader Service Card.

CUT 1/4 INCH STEEL PLATE EASILY AND IN ABSOLUTE SAFETY

with the **FENWAY heavy duty NIBBLER**

MODEL EHN



The new, lightweight Fenway 1/4" Nibbler cuts through 1/4" cold or hot rolled steel plus 5/16" aluminum, quickly and easily. Also cuts 8 gauge stainless. Its special design provides absolute safety to the operator and will cut without distortion to material. Clean cutting action reduces need for grinding and buffing edges. Has minimum cutting radius of 8". Weighs only 20 lbs. SEND FOR COMPLETE SPECIFICATIONS OR ASK FOR FREE DEMONSTRATION IN YOUR AREA.

Other Fenway Nibblers are available for a variety of cutting jobs ...help reduce costs as much as 75%.

FENWAY MACHINE CO., INC.
3107 N. Broad St., Phila. 32, Pa.

For More Information Circle No. 21 on Reader Service Card.

HAMILTON—the complete line...the quality line
INDUSTRIAL CASTERS and WHEELS

If you need casters or wheels—specify Hamilton for the finest quality *at the lowest price.* Prompt quotes. Fast deliveries on direct factory orders. Send today for Hamilton's Caster and Wheel Catalog describing hundreds of sizes, styles and capacities.

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HAMILTON CASTER & MFG., CO., 1723 Dixie Hwy., Hamilton, Ohio

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Circle No. 1 on Reader Service Card.

ACRO
WELDER MFG. CO.
MILWAUKEE

WELDING ENGINEERS

MACHINERY BUILDERS

ESTABLISHED
1936

NEW
PORTABLE SINGER SCREEN
PROTECTION ON ALL 4 SIDES

NOW — a lightweight portable screen designed for complete enclosure. Easy, fast slip-joint assembly (no threads). Rust-proof finish. In 3 curtain materials: JOHNS-MANVILLE ALUMINIZED ASBESTOS cloth — the last word in protection . . . neoprene-coated FIBER GLASS . . . 12 oz. fire-resistant DUCK. All sizes. Also available in single and three-sided models. Ask your dealer or write us.

16 PAGE CATALOG
Complete line of work gloves, welding gloves and safety clothing.

Special Products Division
SINGER GLOVE MFG. CO.
860 W. Weed St., CHICAGO 22, ILL.

SEE OUR AD IN WELDING DATA BOOK

Circle No. 65 on Reader Service Card.

Bar And Angle Shear

Round, square, flat and angle iron can be sheared in the field with a portable bar and angle shear which has a 5 h.p., 4 cycle gasoline engine. This machine is an addition to the line of Shearease machines manufactured by The Shearease Company. Capacity that can be sheared is 1" round, 1" square, 3½" x ⅜" flat and 4" x 4" x ⅜" angle iron as well as smaller bar and angle sizes. Shearease is a self contained portable unit weighing approximately 650 pounds. It is hydraulically operated with a vane pump.

Circle No. 214 on Reader-Service Card.

Hard Surfacing Wires

A new line of Wear-O-Matic hard surfacing wires for submerged arc automatic application has been announced by Alloy Rods Company. The new line consisting of six alloys in ⅛", 5/32", and 3/16" diameters precision cold drawn to plus or minus 0.002". The compression of the filler material to a near solid results in a weld deposit having highly uniform chemistry and physical properties. 100 lb. layer wound coils are packaged for full protection against corrosion and dirt.

Circle No. 216 on Reader Service Card.

Chemical Polishing Dip For Stainless Steel

Ox-Off Lustre Dip is a new chemical process that completely eliminates all forms of electro polishing, machine and hand buffing. By immersing stainless steel in Ox-Off Lustre Dip for short period of time, a mirror like finish is imparted to the surface.

The process does not involve the use of electrical current in any way. Lustre Dip levels off slight scratches and mars, leaves a polished, smut-free surface.

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GO

. . . anywhere with this portable welder

M&T Murex Liquid-cooled Gas Engine Welder

Weight-saving construction • Long-life engine coupled to dual-field, self-excited, quick-response generator • Time delay for automatic idle when not welding • Single current selector, easily set for electrode size • Current peaks limited, even at extreme ends of range • Voltage self-adjusts to suit specific welding conditions • "Popouts" prevented by instant voltage recovery • Write for data.

M&T welding products

METAL & THERMIT CORPORATION
General Offices: Rahway, New Jersey

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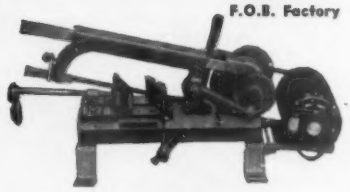
Circle No. 63 on Reader Service Card.

A Rugged . . . Versatile

POWER HACKSAW

COMPLETE ONLY $85.00

F.O.B. Factory



JEFFERSON "601"

Complete with motor and switch, wired, ready-to-go.

SAWS . . . bar, round, angle or pipe up to 4" x 4".

RUGGED . . Cast base, heavier guide bar support arms and guide bar with adjustable bronze wear plate and Oilite bearings throughout.

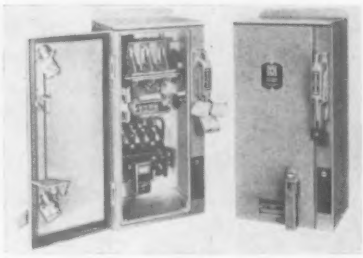
FEATURES . include fast acting 45° swivel vise, pressure relief on back stroke, length gauge bar, motor mount and ¼ h.p. motor. Built by builders of power hacksaws for industry since 1931.

Order from your Welding Equipment Dealer or write direct for details or prompt shipment.

KELLER DIV.

Sales Service Mfg. Co.

2365 University Ave., St. Paul 14N, Minn.



Combination Starters

A new switch-type line of starters, furnished in NEMA 12 dust-tight enclosures, has been announced by the Square D Company. Extra safety is built-in.

The disconnect operating handle is attached to the switch, eliminating a false indication of switch position when the door is open. The handle always controls the switch; the door won't open unless the switch in ON; the switch won't work unless the door is locked and sealed.

Switches will take 250- or 600-volt fuses and can be easily ganged.

Circle No. 208 on Reader Service Card.

General-Purpose Electrode

A new electrode developed by A. O. Smith Corp. is said to reduce spatter loss up to 60 percent and eliminate selection and storage of a number of electrodes of its kind.

Like conventional E 6012 electrodes—the most widely used type—SW 612 is noted for high-speed production welding where fitup is poor. Cleaning time is low, deposit efficiency up 15 percent at high currents, and quality of deposit good.

Circle No. 209 on Reader Service Card.

Power Rectifier Stacks

New silicon stacks that can be adapted quickly to any unit configuration have been announced by Syntron Co. Standard assemblies have either Style 21 or Style 33 diodes. Bridge assemblies with Style 21 rate 39 amps single phase and 58 amps 3 phase. Assemblies with Style 33 rate 75 and 112 amps. All stacks are available with cell voltages to 600 P.I.V.

Circle No. 210 on Reader Service Card.

Get the lion's share of meaty facts out of this issue of WELDING DESIGN & FABRICATION before you pass it along to the next reader. Leaf through once more: If you want full details on any item, the Reader Service Card will bring them to you quickly. No postage needed.

Circle No. 49 on Reader Service Card.

MURCO POWER DRIVEN **forge hammers**

BELT DRIVEN 5 SIZES

MOTOR DRIVEN

Extremely powerful yet comparatively simple in design, MURCO Power Driven Forge Hammers can be operated under perfect control and with very little effort. Illustrated are the five sizes of motor driven models made in 25; 50; 100; 250; and 500 pounds RAM. The RAM design is a special feature . . . a steel casting, balanced and carefully machined, operates in V guides . . . large bearings for toe and toggle bolts . . . guide bearings extra long and wide. Perfect alignment of Ram Travel prevents twisting because the Ram is parallel with travel—a very important feature. Write today for complete specifications and price on the model to meet your requirements.

MURCO Power Driven Forge Hammers are also made in five models belt driven in 25; 50; 100; 250; and 500 pound ram sizes.

MURCO

D. J. MURRAY MANUFACTURING CO.

Manufacturers Since 1883 WAUSAU, WISCONSIN

Circle No. 50 on Reader Service Card.

Automatic Fusion Welder

The design of a new fully-automatic fusion welder of the boom manipulator type has been announced by Sciaky Bros., Inc. Two of these machines were built for North American Aviation where they have been thoroughly shop-tested for economy, flexibility, and effectiveness in welding high-heat resistance heat-treatable alloys of various configurations.

Principal features of the machine are: flexibility to weld in any position—it can continuously weld through a complete circle of 360 degrees; automatic step welding—to get uniform penetration as material thickness changes; multiplicity of movement—in-and-out weld motions of the boom, 360° torch rotation, and fine head adjustments; special drive control—all positioning controls are in operation during welding; seam-tracking system—to follow a vagrant seam as much as 4-inches off axis in horizontal and vertical planes; and, TV weld monitor.

Circle No. 211 on Reader Service Card.

Rectifier-Type Welder

The new rectifier-type Aircomatic Fillerarc DC welder now available from Air Reduction Sales Company combines the tested features of a rising characteristic power source with the advantages of transformer-rectifier design. Suitable for both manual and automatic welding on all weldable metals, its primary advantage is stepless adjustment of arc length and rate of rise for various wire diameters.

The welder is rated at 450 amperes, DC, 40 volts, 100% of duty cycle. Specifications: weight 665 lbs.; height 28″; width 25″; and length 46½″. Functional design allows machines to be stacked or placed side by side for parallel operation in confined spaces.

Circle No. 212 on Reader Service Card.

For More Information Circle No. 70 on Reader Service Card.

CUTTING PIPE?

Do it the easy way...

★ NO EXPERIENCE NEEDED
★ NOT NECESSARY TO CHUCK THE PIPE
★ NO INTRICATE SETTINGS

produce straight or beveled cut-offs, saddle and insert-type tee intersections, lateral intersections and miters with this easiest-to-use "one-man pipe shop"

VERNON *PIPE-CUTTING* PANTOGRAPH

OUTSTANDING PANTOGRAPH FEATURES and ADVANTAGES

• Extremely simple to operate—no special skill required • Handles any length pipe—2″ to 42″ O.D. • No layout or templates required • No hand trimming—all cuts are smoothly finished and beveled • No chucking required • Makes uniform cuts on production runs • One-man operation • Machine can be portable—adaptable to any current

Write for Bulletin No. P-10

VERNON TOOL CO. LTD. 1101 MERIDIAN AVE., ALHAMBRA, CALIF.

HIGHEST YIELD

Always nearby—in the ***BIG RED DRUM.*** *Wire for supplier...*

NATIONAL CARBIDE COMPANY
A DIVISION OF AIR REDUCTION COMPANY, INC.
150 East 42nd Street, New York 17, N.Y.

For More Information Circle No. 51 on Reader Service Card.

Circle No. 11 on Reader Service Card.

BATEMAN
BANTAM
IRON WORKER

THE ONLY IRON WORKER OF ITS KIND ON THE MARKET TODAY

No Grinding Necessary After Cut. One Stroke Cycle Clutch Operated by Hand or Foot.

The Bateman "Bantam" cuts 2" x 2" x ¼" angles and ¼" x 4" flats. Standard punches will fit this machine. The Coper will cope 1¼" through ⅛" material. It will punch ½" hole through ¼" material. With the clutch open, the Bantam will make 44 strokes per minute. It is made of high-grade cast iron, with the clutch, pin and dog made of hardened steel. The blades are made with tool steel. It is powered with a fly wheel and gear drive, and uses a small ¾ hp motor, 1750 rpm.

Bateman Bantam with punch....$575.00
Shear only $495.00
Shipping wt. 750 lbs.

BATEMAN FOUNDRY & MACHINE
MINERAL WELLS, TEXAS

BECKER
Keen-Cut Electrodes
for use in

CARBON ARC-AIR JET GOUGING

KEEN-CUTS—for the best characteristics of carbon and graphite in a carbon arc cutting electrode. Higher current capacity ... longer life ... shorter cutting time ... greater material removal ... smooth surface gouge ... controllable accuracy ... hot stable cutting arc ... elimination of smoke and gases.

And they're low in cost. Try BECKER KEEN-CUT ELECTRODES—black or copper coated, standard diameters, 12" lengths in 150 to 1400 amp. range—for the most efficient, labor-saving electrode in carbon arc/compressed air cutting.

A COMPLETE LINE OF CARBON AND GRAPHITE WELDING SUPPLIES—carbon and graphite electrodes, carbon rods and plates, welding paste, graphite cores and chills, graphite powder and particles of any mesh.

Write for Catalog

BECKER BROTHERS CARBON CO.
3442 South Laramie Ave. • Cicero 50, Illinois
Circle No. 12 on Reader Service Card.

REFERENCE DATA *catalogs, handbooks, manuals*

32 MULTI-SPOT and projection resistance welding machines are the subject of a 12-page brochure offered by the Taylor-Winfield Corp. Data includes: end product, operation, production rate, welding machine specifications, and material handling equipment. The bulletin describes such special features as: automatic loading, welding techniques, and inspection. **For More Information Circle No. 300 on Reader Service Card.**

COMPLETELY REVISED BOOKLET describing Dual Shield welding, the equipment, and the flux-cored electrodes is available from National cylinder Gas Div., Chemetron Corp. The new WC-1 welding control and the AM-1 torch are pictured and described. Electrodes and process applications are listed. **For More Information Circle No. 301 on Reader Service Card.**

BENDING BLOCKS, tools, and accessories are discussed in a 4-page brochure released by Acorn Iron & Supply Co. Illustrations are provided to show arm clamp, bending post, hold-down nut and bolt, gooseneck hold-down dog, tapered drift pin, and horizontal clamp. Specifications are given for bending block stands. **For More Information Circle No. 302 Reader Service Card.**

FLAME SPRAY PROCESSES are covered in a 16-page booklet published by Metallizing Engineering Co., Inc. Illustrated and described are the metallizing process which sprays powdered metals; and the new Metco Plasma Flame Spray process which develops temperature up to 30,000F and can spray any material that can be melted without decomposing. In addition, coating characteristics are given. **For More Information Circle No. 310 on Reader Service Card.**

A BENCH-TYPE SPOT WELDER is the subject of a specifications sheet released by Asea Electric, Inc. The SVGP 042 is a small foot-operated quill-type machine intended for spot welding of small components. The brochure gives complete specifications. **For More Information Circle No. 303 on Reader Service Card.**

ALL FUTURE LITERATURE published by Air Reduction Sales Co. on pressure regulators will show Flow Rating Data. The reason: to reduce the purchaser's confusion brought on by several methods of rating flow. Airco will list two ratings: Maximum Free Flow (MFF) and Maximum for Conventional Applications (MCA). **For More Information Circle No. 304 on Reader Service Card.**

ALLOY SPECIFICATIONS BULLETIN REVISED. Chemical and physical properties of aluminum bronze alloys are contained in a revised bulletin published by Ampco Metals, Inc. Nine grades and heat treated variations are described in the 20-page, 2-color bulletin. Chemical limits and applications are given for each grade. **For More Information Circle No. 305 on Reader Service Card.**

PORTABLE THERMAL UNIT for x-ray or photo-film processing is the subject of a well-illustrated catalog and price sheet prepared by Frigidheat Industries. These key points are described: no plumbing; correct solution temperature; cool or heat; for any tank or tray; shockproof; inexpensive installation. Complete specifications are given. **For More Information Circle No. 80 on Reader Service Card.**

FACTS AT YOUR FINGERTIPS: *If you want copies of the catalogs featured on these pages, just circle the appropriate numbers on the bound-in Reader Service Card. We'll do the rest.*

AN ENGINEERING data sheet from Wall Colmonoy Corporation's Stainless Processing Division describes the Nicrocoat surface protection process for oxidation, corrosion and abrasion resistance. The two-page data sheet covers application methods, thickness specifications and fusing procedures.

Circle No. 306 on Reader Service Card.

REFERENCE CHART "Basic Guide To Ferrous Metallurgy" is offered by Tempil Corporation in a 4-color, 8½ x 11 format. Ideal for the engineer, metallurgist, or skilled operator, chart gives characteristics of steel (up to 0.9 carbon). It also shows important working zones: preheating, stress relieving, normalizing, and annealing. 24 common metallurgical terms are defined.

Circle No. 68 on Reader Service Card.

INDUCTION EQUIPMENT for automated metal heating is the subject of Robotron Corp's new folder. Folder explains available technical services such as: problem analysis, research, design engineering, and manufacture. It illustrates equipment that will do the job, in addition to, standard heating units.

Circle No. 307 on Reader Service Card.

FREE FLUX SAMPLES are available from Krembs & Company, manufacturer of 25 different welding, brazing and soldering fluxes. Write for yours on company letterhead. Use Reader Service Card for literature.

Circle No. 36 on Reader Service Card.

COMPREHENSIVE WELDING ELECTRODE CATALOG, EW-212 (Illustrated, 26 pages) is available from Hobart Brothers Co. It covers Hobart's complete line of—welding electrodes, gas welding rod, non-consumable electrodes, submerged arc welding flux, and automatic welding wire. In addition to a handy application diagram, complete information is given for each electrode.

Circle No. 309 on Reader Service Card.

What Hackney quality means to you

Hackney MILWAUKEE

- Maintenance costs cut—smooth surfaces clean easily, paint quickly.
- Eye appeal—no crevices, cracks or ridges. Modern appearance for industrial and medical applications.
- Uniform capacity, controlled weight—filling, handling and record-keeping are simpler.
- Rugged construction that lasts. Hackney has spelled quality since 1902.
- Far exceeds ICC specifications.
- Sound investment. Hackney quality costs no more, and it gives you extra features: accurate threading, neater appearance and legible stamping.
- Complete range of sizes and shapes—from small medicals to 220's, 250's and 300's (cu. ft.).
- Central shipping location means faster service, with less freight charges.

Economical, strong, safe Hackney cylinders are your dependable shipping containers for compressed industrial gases. Your nearest Hackney representative will be glad to give you complete specifications and quote prices.

Pressed Steel Tank Company

Manufacturer of Hackney Products Since 1902

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CONTAINERS AND PRESSURE VESSELS FOR GASES, LIQUIDS AND SOLIDS

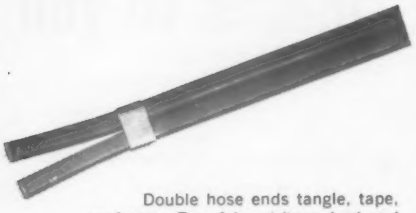
For More Information Circle No. 56 on Reader Service Card.

Oxweld GUIDE

TO BETTER WELDING AND CUTTING

Six popular accessories... and why so many experienced welders prefer them...

Large vented nylon cups fit comfortably over prescription glasses. No. 24 Goggles lift with one hand because the bridge is rigid. Standard AA green lenses, 3 shades.



Double hose ends tangle, tape, confusion. Two 1-braid lines (red and green) molded side by side for easy handling. Tough but flexible connecting web, smooth cover.

Eliminate clogged tips with OXWELD Tip Cleaners. Remove oxides and carbon deposits without damaging accurately dimensioned ports. Master set cleans 46 drill sizes.

OXWELD Welding Gloves are luxuriously soft, yet tough and long-wearing. Long gauntlet protects wrists and forearms. Suede leather, flame-resistant fabric, or combination.

OXWELD Lighter provides fat, sure-fire spark every time, because flint strikes file at an angle. Self-cleaning file turns automatically, will not clog or fill up.

Two of toughest pre-weld and post-weld cleanup brushes in the business. Full count of firmly anchored wires. Scraper makes short work of dirt, flux residue, and spatter removal.

Call your LINDE Distributor for prompt service on any welding or cutting need. Or write for his name and address to: Dept. 510, LINDE COMPANY, Division of Union Carbide Corporation, 30 East 42nd St., New York 17, N.Y. *In Canada:* Linde Company, Division of Union Carbide Canada Limited, Toronto.

"Linde," "Oxweld," and "Union Carbide" are registered trade marks of Union Carbide Corporation.

Linde UNION CARBIDE

For More Information Circle No. 40 on Reader Service Card.

PRACTICAL APPLICATIONS for metallizing is the subject of an 8-page brochure published by Metallizing Engineering Co., Inc. Applications include: machine maintenance, repair, production, salvage, and corrosion prevention. Typical jobs and procedures are described.

Circle No. 46 on Reader Service Card.

INCREASED PROFITS, REDUCED COSTS is the title of a 4-page brochure released by the W Corporation. Literature explains how Hotbox, a new welding electrode moisture stabilizer, assures constant protection against moisture; keeps them in the best welding condition. Specifications and construction of the portable unit are included.

Circle No. 73 on Reader Service Card.

HOSE CLAMPS that won't sag and leak are the subject of a detailed catalog published by Punch-Lok Company. Catalog lists a complete range of hose clamp sizes.

Circle No. 57 on Reader Service Card.

POWER DRIVEN FORGE hammers made by D. J. Murray Mfg. Co. are the subject of an illustrated brochure. Described and illustrated are five motor-driven models and five belt-driven units.

Circle No. 50 on Reader Service Card.

THE EASY WAY to cut pipe is explained in Bulletin P-10 from Vernon Tool Co., Ltd. The Bulletin describes in detail features and advantages of a pipe-cutting pantograph machine.

Circle No. 70 on Reader Service Card.

A PIPE CUTTING SYSTEM that speeds joint preparation on pipe and tubing is the subject of a free booklet from Wallace Supplies Mfg. Co. The booklet explains the company's new, revolutionary DeWitt System of joint preparation.

Circle No. 75 on Reader Service Card.

WELD CHIPPING HAMMERS is the subject of a catalog sheet issued by Quality Tools Corp. Literature tells how heat-treated handle with fire-resisting plastic grip is resilient, and how the fine tempered alloy blade makes quick work of chipping.

Circle No. 314 on Reader Service Card.

RUBBER-CUSHIONED ABRASIVES are covered in a new 16-page catalog issued by Brightboy Industrial Division. Methods and application data, machine and manual operations, machine speeds and listings of abrasive textures and stock sizes are included. The line of 49 stock Brightboy compounds are listed.

Circle No. 315 on Reader Service Card.

NEW WELDING SEAM TRACER is featured in a comprehensive 8-page folder prepared by the Welding Machine Company. Discussed are the principle of operation and construction of the automatic Weldma head with arc length control, extension arm, inert arc welding torch, wire guide, and wire feed.

Circle No. 316 on Reader Service Card.

FIRE-FIGHTING EQUIPMENT made by Ansul Chemical Co. is the subject of a new, comprehensive catalog. Listed are hand portable extinguishers, stationary fire equipment, piped systems and large-capacity mobile equipment, such as fire jeeps and trucks.

Circle No. 317 on Reader Service Card.

HYDRAULIC PRESS BRAKES are the subject of 12-page catalog just issued by Dreis & Krump Mfg. Co. Catalog HP-59 describes in detail the construction and operating features of 55 standard models; specifications are given for each. Illustrated and described are optional features available as extras for special applications and requirements. The company's *Chicago* hydraulic press brakes are available in sizes from 100- to 2000-ton capacity.

Circle No. 318 on Reader Service Card.

LEAK TESTING of tanks, piping, and other enclosures that can be pressurized is discussed in an attractive 6-page bulletin released by General Electric. It instructs in the use of halogen leak detectors on applications like these: aircraft and missile fuel and hydraulic systems, steam boilers, and valves.

Circle No. 319 on Reader Service Card.

POCKET-SIZED, snap-around volt-ammeter-ohmmeter called Amprobe is the subject of a 4-page booklet issue by Pyramid Instrument Corp. Several models are described and illustrated along with the featured RS-3.

Circle No. 320 on Reader Service Card.

MOUNTED WHEELS made by Cincinnati Milling Machine Co. are the subject of Booklet PG-358. The booklet describes the features of these wheels. It contains a complete wall chart showing all standard shapes and sizes.

Circle No. 321 on Reader Service Card.

A NEW COLOR RANGE in flexible insulators for Mueller Clips is featured in a data sheet. White, yellow, green and blue have been added to the familiar red and black for quick, easy and positive identification of clip-equipped leads.

Circle No. 322 on Reader Service Card.

RUBBERIZED ABRASIVES and how they are used for deburring, smoothing and polishing is the subject of an 8-page industrial catalog available from Cratex Mfg. Co. The catalog contains operating instructions, application information, tables, illustrations and latest technical data.

Circle No. 323 on Reader Service Card.

HAND TORCHES for gas welding and cutting are the subject of a newly revised 36-page catalog issued by Air Reduction Sales Co., Form ADC 702E features the company's complete line of gas welding and cutting hand torches, outfits, tips and accessories.

Circle No. 324 on Reader Service Card.

Your "LINDE" Distributor WANTS TO HELP YOU... TO DO A BETTER JOB!

Your success is his success. As your business improves, his business with you increases. As your confidence in him grows, it benefits you both.

Your local LINDE Distributor offers a complete line of industrial gases, equipment, and supplies. He can satisfy almost any welding or cutting need *from stock.*

Difficult welding or cutting problems? See your LINDE Distributor. His technical background and experience, backed by Linde Company resources, can help get you on the right track quickly.

Talk with your LINDE Distributor today. As an independent local businessman, he is vitally concerned with your success. If you can't find his name in your telephone directory, write for it. Dept. 310, LINDE COMPANY, Division of Union Carbide Corporation, 30 East 42nd St., New York 17, N. Y. *In Canada:* Linde Company, Division of Union Carbide Canada Limited, Toronto.

Linde

UNION CARBIDE

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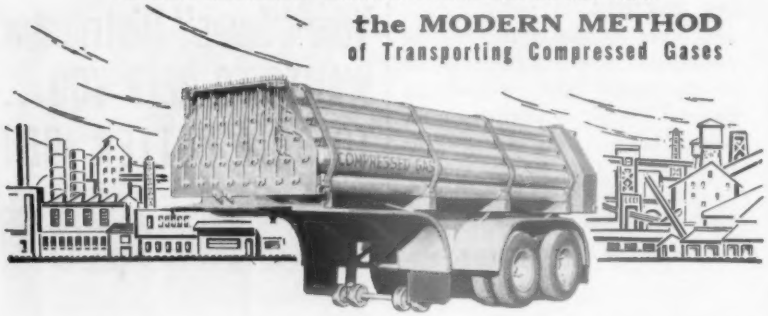
Circle No. 41 on Reader Service Card.

For More Information Circle No. 32 on Reader Service Card.

the MODERN METHOD
of Transporting Compressed Gases



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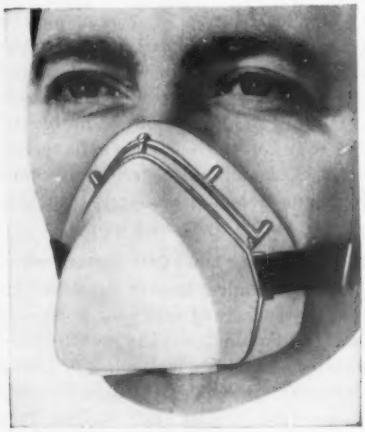

NEW
filter respirator
actually
comfortable
to wear

More efficient —
costs less, too!

We don't say your workers won't know they're wearing our new Resp-R-Aid mask. But it's a fact the edges of this remarkable *urethane foam* mask are so soft and pliable they literally *caress* the natural contours of *any* face, closing all gaps with no discomfort. Yet the mask weighs hardly more than an ounce.

The entire mask is a filter. More than 25 square inches of micro-porous urethane. Up to 8 times the filtering area of most masks. Breathing is easy, natural, *comfortable* because thousands of interconnected cells trap foreign particles, but let air pass freely. Resp-R-Aid lasts longer, too; you wash it out in seconds. And every Resp-R-Aid is factory-sanitized with bacteria-static quaternary agents.

Yet for all its comfort and efficient protection against mists, sprays and nuisance dusts, Resp-R-Aid costs only $1.95. Replacement filters available. Watchemoket Optical Company, Inc., 232 West Exchange St., Providence 3, Rhode Island. Throughout Canada: Levitt-Safety Limited.

WATCHEMOKET
Resp-R-Aid®
U.S. Patents Applied For

For More Information Circle No. 76 on Reader Service Card.

Tec Torch Patents Transparent Nozzles

CARLSTADT, N. J.: Transparent gas nozzles that are an integral part of tungsten arc welding torches made by Tec Torch Co., Inc., have been recognized by the Patent Office of the U. S. Government. The nozzles, which are made of *Vycor* glass, are now covered by Patent #2,928,933.

Welsh Opens New Southwest Warehouse

DALLAS, TEXAS: Welsh Manufacturing Co., manufacturer of industrial and welding safety products, has opened new warehouse facilities here at 142 Howell St.

Earl Mitterlener will be resident manager.

Howe Sound Acquires Peterson Machine Tool

DANBURY, CONN.: Howe Sound Company has announced the acquisition of the outstanding stock of Peterson Machine Tool, Inc., Merriam, Kansas, manufacturers of magnetic particle inspection equipment. Peterson will become part of Sperry Products Co., a Division of Howe Sound, located in Danbury.

Titan Produces Bronze Welding Rod In The West

NEWARK, CALIF: Volume production of a complete line of bronze welding rod, believed to be another first for the 13-state West, including Alaska and Hawaii, is under way here in the western headquarters plant of Titan Metal Mfg. Co., Division of Cerro de Pasco Corp.

Wall Colmonoy Opens New Dayton, Ohio, Plant

DAYTON, OHIO: A new plant for stainless alloy brazing and furnace heat processing has been opened here by the Stainless Processing Division of Wall Colmonoy Corp.

Circle No. 47 on Reader Service Card.

No Other Product Can Do a Galvanizing Job Like *Galvalloy* Does - HERE'S PROOF

Heat welded seam on galvanized sheet to 600° with Torch

Rub GALVALLOY against heated surface as shown — now spread with wire brush for a bright finish.

GALVALLOY Covers the Same Amount of Area with 1/5 the Amount of Material.

Send today for Testing Sample and you'll learn Why GALVALLOY has no equal for ANY Galvanizing Job.

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1233 S. BOYLE AVE., LOS ANGELES 23

WE HAVE THE FLUX RIGHT For Your Job

62 years of experience in scientific development in welding

Whatever the particular job you have to do—we have the right FLUXINE you need. Besides our 25 FLUXINES we carry a complete line of "KOP-R-ARC" coated rods for welding copper and all copper alloys.

Write on company letterhead for chart and generous sample stating which FLUXINE desired.

KREMBS & COMPANY
(Est. 1875)
Dept. K, 669 W. Ohio St., Chicago 10, Ill.

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AMBRAZE QUALITY BRAZING ALLOYS

Fully Guaranteed Materials
Meets all Gov't, AWS, ASTM Specifications.

Low Fuming Bronze Rod—
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Write today for full details
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OXYGEN PLANT

Superior, modern plant, 5 years old, recent installation, in first class condition. Capacity: 1900 cu ft/hr oxygen or 7000 cu ft/hr nitrogen, Location: Montreal. L. V. LaRue, Wall Colmonoy Corp., 19345 John R Street, Detroit 3, Michigan.

IAA

continued from page 15

More recently, research chemists have been experimenting with acetylene as a chemical raw material. Great numbers of chemicals and commercial products have been synthesized for chemical purposes, IAA has put increased emphasis on handling of "chemical" acetylene.

Because it is an essential ingredient of the oxy-acetylene process, oxygen and some of the problems of its handling also receive IAA attention.

Soon—on May 9 and 10—the 60th annual meeting of IAA will take place in San Francisco at the St. Francis Hotel. The program of that meeting, like those that have preceded it, will be aimed at our basic Association objective—encouraging the development of safe, dependable, and efficient methods of manufacturing, distributing, and using carbide, acetylene, oxygen, and related products.

Toward that objective, the IAA cooperates with local and other authorities on regulatory matters which may affect our industry. Our constant promotion of safety also means working closely with other associations and groups which have a similar or related objective. • •

Circle No. 15 on Reader Service Card.

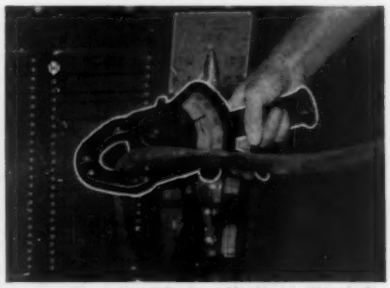

Photo Courtesy The Lincoln Electric Co.

now . . .
ONE AMMETER for AC/DC WELDERS

Only **TONG-TEST** measures both AC and DC

Weld with confidence. Use the exact amperage — no more, no less—to assure welding quality. Prevent costly rejects by controlling the welding current (AC or DC) with one TONG TEST AMMETER. Simply snap tongs around electrode cable — read amps instantly and accurately. No electrical connections required, cannot burn out. Interchangeable ranges up to 1000 amperes.

Write for Catalog IW-400

COLUMBIA ELECTRIC MFG. CO.
4545 Hamilton Avenue • Cleveland 14, Ohio

EISLER makes the largest assortment of **ELECTRIC SPOT, WIRE BUTT, SEAM, TWEEZER, GUN** and **FLASH WELDERS.** We also carry in stock a variety of **WELDING TIPS** and **ACCESSORIES.**

EISLER ENGINEERING CO., INC.
735 So. 13th St., Newark 3, N.J.

Circle No. 79 on Reader Service Card.

For More information Circle No. 3 on Reader Service Card.

DOC TUFFY
TO THE RESCUE
!!*@#?!!
I CAN'T STAND IT, DOC TUFFY EITHER THOSE MUSHROOMED TIPS GOTTA GO... OR I DO!
FOR YOUR CONDITION, I PRESCRIBE REPLACEABLE TUFFCAP TIPS
Mushroomed spotweld tip? Don't throw it away! Toss out the worn end . . . re-use the shank! You can when you use replaceable TUFFCAP TIPS and long-life TUFFALOY SHANKS.
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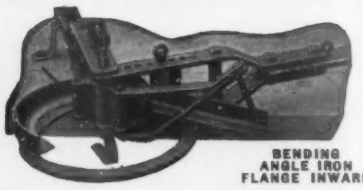
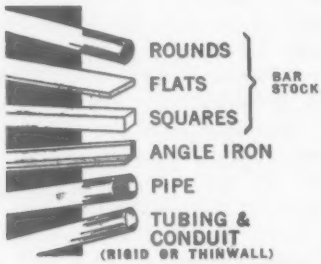
HOSSFELD # 2 Universal®

Iron Bender Bends

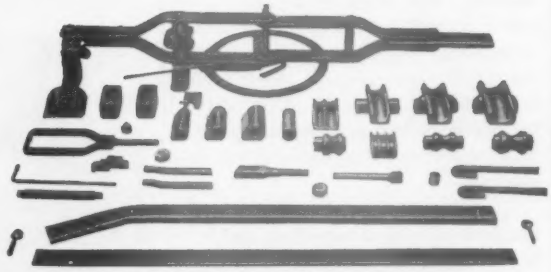


BENDING ANGLE IRON FLANGE INWARD



35 Years Of Metal Bending Experience

- Wrenchless, it's ready to use.
- Practical, it's quickly set up.
- Adaptable, it replaces special equipment.
- Versatile, 147 different dies are available.
- Dependable, it's a "must" for maintenance and limited production work.
- Invaluable, optional hydraulic equipment makes the job easier.
- Indispensable, it's as necessary as a shop vise.



BENDER SHOWN WITH REGULAR EQUIPMENT

FREE! WRITE FOR BENDER BULLETIN

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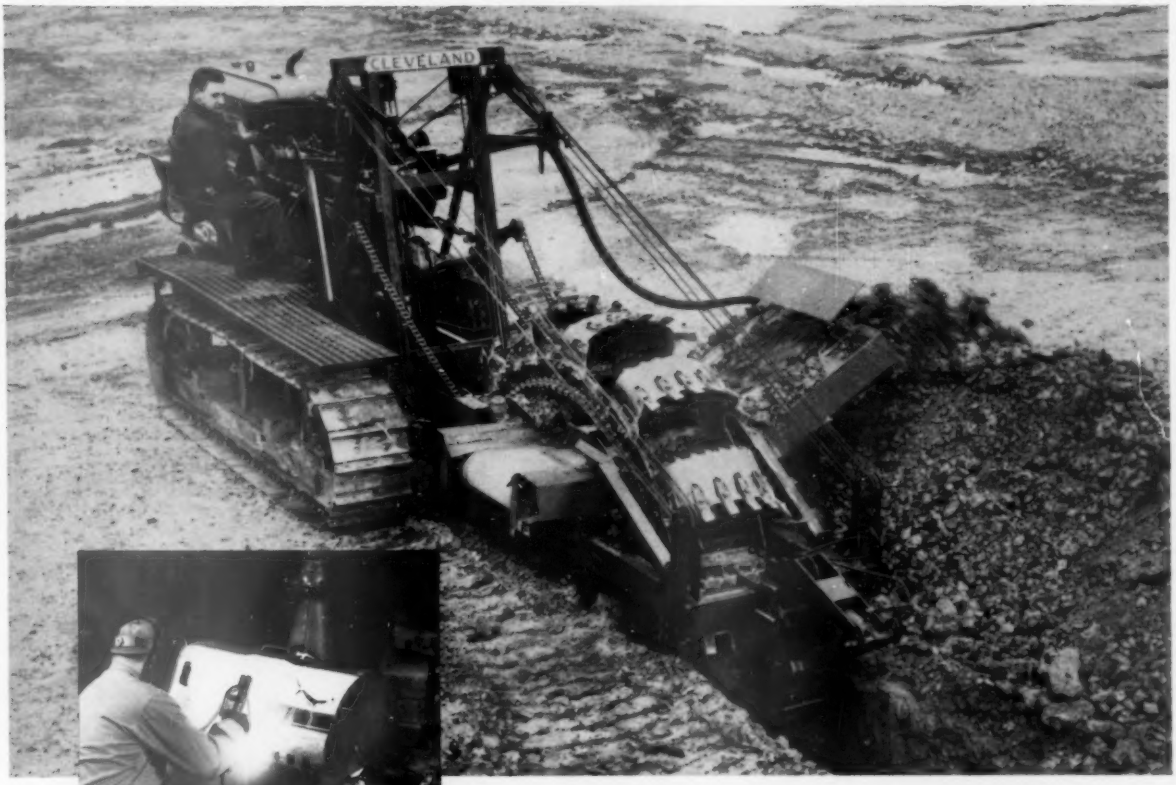

CADDY Type K-45 (400 Amp.) ELECTRODE HOLDER and E-60-12 electrode used to join the segments of the digging wheel rims for the Model J-40 CLEVELAND TRENCHER —Cleveland Plant.

CLEVELAND TRENCHER

uses CADDY

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CLEVELAND TRENCHER COMPANY (Cleveland, Ohio), world's leader in manufacturing trenching equipment uses arc welding as a method of construction for their entire line of trenchers.

Low hydrogen rod is used for joining the segments of the digging wheel rims. Hard facing rod is then used on the inside diameter of the digging wheel. The lugs for the digging buckets are first tack-welded and then seam welded. Even the chassis is completely welded.

Building the CLEVELAND TRENCHERS rugged enough to withstand the continued wear on the buckets and entire trencher demands quality construction and the production department demands peak efficiency on all manufacturing equipment.

Besides the CADDY Type K-45 ELECTRODE HOLDER, CLEVELAND TRENCHER is standardized on complete CADDY arc welding circuits. These circuits include: ground clamps, quick connectors, lugs and splices, all connected to the welding cable by the CADWELD CONNECTION. The CADDY circuits surpassed all competition for continued rugged performance and cool operation.

CADDY® Arc Welding Accessory Div.

Erico Products, Inc.

2070 E. 61st Place • Cleveland 3, Ohio

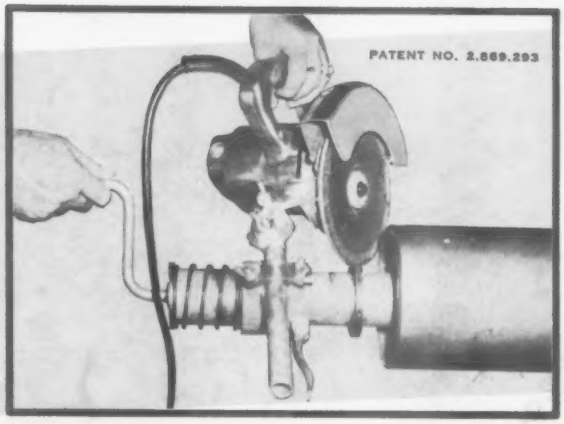
IN CANADA: ERICO INCORPORATED, 7 Superior Ave., Toronto 14, Ontario, Canada

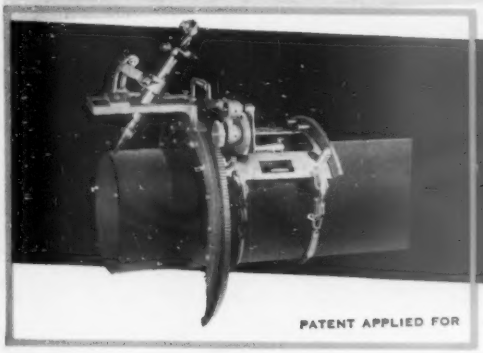
For More Information Circle No. 19 on Reader Service Card.

H&M . . . THE INDUSTRY'S LEADING LINE

featuring the new H&M "BEVEL-LAND" GRINDER

The new **H & M "BEVEL-LAND" GRINDER** uses an electric or air-powered grinder to prepare pipe for welding by cleaning and smoothing pipe cuts and putting the land on bevels. The new machine eliminates the old, time-consuming method of using a file and hammer, or hand grinder, for this work. The GRINDER may be placed in the pipe and in operation in less than one minute. A simple adjustment of the angle of the grinding head is all that is required to change the machine from the cleaning to the land position. The "BEVEL-LAND" GRINDER is available in two models: one for 6" to 14" and one for 14" to 36" pipe.





H & M STANDARD MACHINES — The seven models of H & M Pipe Cutting and Beveling Machines are designed to handle 1½" through 36" pipe. They operate with speed and accuracy . . . in the field or in the shop . . . under the toughest conditions

H & M ACCESSORY EQUIPMENT — Shape Cutter . . . to cut saddles, tees, els. Out-of-Round . . . to cut egg-shaped pipe. Motorized Units . . . to speed operations. Flexible Shaft . . . to assure complete visibility. Pipe Dollies . . . to make pipe handling easy. Boxes . . . to protect H & M Machines. Clamps . . . to align pipe accurately.

THE H&M LINE CAN LEAD YOU TO MORE SALES . . . MORE PROFITS FROM PIPE CUTTING AND BEVELING EQUIPMENT. WRITE TODAY FOR COMPLETE DETAILS ON AN H&M DEALERSHIP.

H&M T.M Reg

PIPE BEVELING MACHINE COMPANY

311 East Third St. Phone Diamond 3-0241

TULSA, OKLAHOMA

For More Information Circle No. 23 on Reader Service Card.